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Volume II. Policy Analyses

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16. ABSTRACT

This three volume report contains the results of a project to assess the probable impacts of expected future development of Texas lignite resources. This multi-disciplinary, policy-oriented study considered possible lignite extraction and utilization options through the year 2000. The research team attempted to identify and characterize the amjor environmental, socio-economic, public health and institutional impacts which could result from this process and the policy issues created or aggrevated by these impacts. Alternative solutions to policy problems are outlined with probable consequences of each.

Volume I contains Technical Analyses, including: evaluation of the potential for use of lignite, the likely siting patterns of lignite facilities, and the environmental and socio-economic impacts of lignite use. Volume II contains Policy Anslyses which identify major public policy issues related to lignite use in Texas and discuss the alternative policies available for resolving the issues. Volume III contains technical working papers.

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AN INTEGRATED ASSESSMENT OF TEXAS LIGNITE DEVELOPMENT

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FOREWORD

Recent years have witnessed increasing awareness of the declining availability of our most widely used energy sources - oil and natural gas - accompanied by sharp increases in price. Both direct government policy and the market price mechanism are now operating to stimulate a shift away from oil and natural gas to other fuels wherever possible. One area in which this shift is likely to be especially pronounced is the Gulf Coast. There, massive electric utility and industrial capacity is fueled by oil and natural gas which have historically been locally plentiful. Assuming this shift continues, other fuels will be required to power both new and existing sources. One promising candidate to fill much of the emerging energy gap in the Gulf Coast region over the near and medium term is lignite which exists in the same general region and appears to be very competitive economically. There are, however, significantly different and more serious environmental consequences associated with extraction, transportation, and utilization of large quantities of lignite than is the case for oil and natural gas.

Thus, this study was conceived as a timely first attempt at defining and analyzing the consequences and constraints associated with the potential extensive use of lignite in Texas (which comprises a major portion of the region in question), and the public policy options available for managing this development. A notable feature of this research effort has been its cooperative interagency character. It has been a valuable experience in federal/state research cooperation between the Department of Energy (DOE) and the Environmental Protection Agency (EPA), two federal agencies for which cooperation is essential in this sensitive policy area, and the Texas Energy Advisory Council, an agency of the State of Texas. In addition, active involvement of the DOE and EPA regional offices was incorporated into the design and management of the study. Efforts required to establish this complex structure were amply compensated for by the range of viewpoints and experience brought into the research design.

The study has been conducted under demanding constraints of both funds and time. The time constraint has been an especially difficult one. From the study's inception, it was agreed that major users to whom this study would be directed were state and local policy makers (although appropriate elements of the federal government, including regional offices, are considered to be major users as well). In that context it was considered essential that the study results be available to the 1979 session of the Texas State Legislature (which meets once every two years). Consequently, only eight months were available to complete this research, limiting the level of detail at which lignite development issues could be examined.

A significant decision made early in the study's planning was to emphasize the aggregate, regional impacts rather than the specific impacts associated with a single mine or power plant. This decision was based on two primary factors. First, because of its geologic and geographic distribution, lignite's development will occur over a broad region of Texas rather than be concentrated in a few limited areas. As such, it was felt that an analysis of the regional impacts of lignite development might yield valuable information not recognized at the level of an individual site. Second, the attempt to hypothetically site future plants at a more detailed geographic level was too complex a task to be completed in a credible manner within the constraints of the study.

Given this perspective, the study team has done an excellent job of analyzing a number of constraints to and consequences of lignite development at the regional level and has pointed out many potential problems which deserve examination at a finer level of detail. Many environmental problems do not become apparent in an analysis at the regional level of aggregation although their cumulative impacts may be substantial. This study should, therefore, be viewed as a "first cut" overview of the issues associated with Texas lignite development. A finer grained analysis is still required in future research studies as well as through the permitting process.

The reader should also be sensitive to the effect of assumptions on conclusions in a study such as this. It was necessary, of course, to make assumptions about a wide range of future social and economic conditions in order to assess the potential impacts of lignite development. Varying these assumptions could substantially alter the study's conclusions. One clear example relates to availability of water for lignite development. Assumptions were made concerning future municipal and agricultural water demand and future development of dams and other measures to augment water supply. Given these assumptions, water availability does not appear to pose a significant constraint to lignite development in most areas of the lignite belt. Other assumptions, however, could have resulted in quite different conclusions. It was not possible within the limits of the study to examine the sensitivity of conclusions to variations in many such assumptions. The reader should, therefore, be aware of the context of assumptions in which these conclusions were drawn and the resulting limits on their predictive validity.

The project team, put together by the Radian Corporation, is to be congratulated for producing a thought-provoking technical and policy analysis report. In addition, special thanks are due to all members of the review panel and to Bill Honker and Mike Gibson of EPA's Dallas Regional Office and Lila Williams of DOE's Dallas Regional Office for unselfish commitments of time and experience to the project.

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READER'S GUIDE

This *Integrated Assessment of Texas Lignite Development* was performed by the Radian Corporation of Austin, Texas, for the Texas Energy Advisory Council. Joint sponsors of the project, with TEAC, are the U.S. Environmental Protection Agency and the U.S. Department of Energy.

The report is divided into sections, as follows:

VOLUME I - Technical Analysis

- Chapter I - Potential Use of Solid Fossil Fuels
- Chapter II - Lignite Development Scenario
- Chapter III - Siting Constraints
- Chapter IV - Environmental and Socioeconomic Impacts

VOLUME II - Policy Analysis

- Chapter V - Policy Analysis

VOLUME III - Technical Working Papers

The organization of the first two volumes of the report follows the sequence of tasks performed in the analysis. Thus, the material in the later chapters is developed from work presented in the earlier chapters. Recognizing however, that most readers will not be equally interested in all of the report's contents, it has been organized for "skipping".

Each of the first four chapters begins with an abstract, summarizing the topics to be discussed. The technical presentation that follows is subdivided into major subsections, each prefaced by a brief summary. The technical presentation is followed by a summary statement of key policy issues arising from the analysis, which will be discussed subsequently in Chapter V. Finally, major data gaps and recommendations for further research are listed, again in summary form. (Chapters III and IV are organized roughly by disciplinary area, with research recommendations at the end of each major section.) Each chapter is followed by its own list of references.

Chapter V contains an analysis of the eighteen policy issues identified in the first four chapters. Each discussion stands alone, and consists of a summary statement of the issue, a table comparing the attributes of alternative actions or policy options, and a short explanatory text. The "meat" of the analysis is in the tables. A final section of Chapter V discusses several underlying issues bearing on lignite development.

Volume III contains a number of technical working papers developed midway through the research project to provide background information on specific areas. The working papers have not been edited or extensively reviewed prior to printing and may contain typographical and informational errors. They do, however, provide summaries of the information which was readily available to the project at the time they were prepared on specific aspects of Texas lignite development. A limited number of these volumes have been printed and will be made available on request from David White, Texas Energy Advisory Council, 7703 North Lamar, Austin, Texas 78757.

A reader wishing to get an overview of the report before deciding which sections to read in detail is advised to begin with Volume I, by reading the abstracts for each chapter, and the summaries of each major section. Then, a brief glance at the summary statements of the issues presented in Chapter V will acquaint the reader with the scope of the policy analysis portion of the study.

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The conduct of the study was overseen by two groups: an Overview Committee representing the three funding agencies, and a Review Panel representing various parties of interest to lignite development, assembled to advise and comment on the technical aspects of the work.

The Overview Committee served to steer the overall direction of the study, and consisted of the following individuals:

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The Review Panel consisted of an invited group of technical experts, interest group representatives, industrial and acedemic personnel, and government agencies involved in lignite development in Texas. This group reviewed the draft reports produced by the Radian study team, and provided expert guidance and suggestions. The present report strongly reflects the valuable contributions of this group, as interpreted by the Radian staff Panel members are not, however, responsible for the contents of the final report nor does it always represent a consensus among the group.

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ACRONYMS AND ABBREVIATIONS

CAA - Clean Air Act of 1977
DoE - Department of Energy
EPA - Environmental Protection Agency
ERA - Economic Regulatory Administration (Department of Energy)
FUA - Fuel Use Act (Portion of National Energy Act of 1978)
HC - Hydrocarbons
LNG - Liquefied Natural Gas
MBFC - Mandatory Boiler-Fuel Conversion
NAA - Non-Attainment Area
NAAQS - National Ambient Air Quality Standards
NEA - National Energy Act of 1978
NO$_x$ - Oxides of Nitrogen
NSPS - New Source Performance Standards
O&M - Operation and Maintenance
PAN - Peroxy Acyl Nitrate
PSD - Prevention of Significant Deterioration
PUC - Public Utility Commission (Texas)
RD&D - Research, Development & Demonstration
RRC - Railroad Commission (Texas)
SIP - State Implementation Plan
SO$_2$ - Sulfur Dioxide
TACB - Texas Air Control Board
TDWR - Texas Department of Water Resources
208 - Section 208 of the Water Pollution Control Act Amendments of 1977, mandating areawide wastewater management
316a - Section 316a of the Water Pollution Control Act Amendments of 1977, dealing with variance procedures for thermal discharges

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CHAPTER V: POLICY ANALYSIS

Abstract

The following chapter deals specifically with eighteen issues arising from the analysis presented in the preceding four chapters. These issues fall into three groups. The first contains issues which set the regulatory context into which lignite development must be fitted. These issues must be resolved at the federal level. The second group consists of issues concerning the allocation of resources, generally resolvable principally by state action. The third group deals with anticipated problems in dealing with the impacts of lignite development. It is divided into issues arising over possible needs for new initiatives to protect environmental and socioeconomic values, and issues over the implementation of laws already in place. Alternatives available to resolve the issues are discussed specifically. Four key underlying issues that tie together the eighteen are also identified. These include: limitations in requirements for comprehensive environmental review; the present incomplete internalization of the costs of chronic health impacts, ecological and aesthetic damage; the difficulty for firms of long-range planning under conditions of regulatory uncertainty; and the conflict between equity and economic efficiency in resource allocation.

1.0 INTRODUCTION

The substance of this Chapter is an analytical look at ways to solve some of the most pressing and obvious problems related to lignite development in Texas. In the four Chapters making up Volume I, key problem areas were evaluated and compared with the availability of institutional mechanisms to cope with them. In some cases, problems can be foreseen for which institutional solutions do not exist, or are insufficient. Solutions would require policy initiatives at some level of government. In other cases, the problem may be in the institutional machinery itself, as when policies with conflicting objectives create an economic or environmental impasse. Each of the first four Chapters closes with a summary statement of policy issues related to its subject. Table 1-1 lists all the issues so identified.

TABLE 1-1. SUMMARY OF POLICY ISSUES

Context-Setting Issues

Mandatory Boiler-Fuel Conversion
Ambient Ozone Levels
Atmospheric Sulfate Regulation
Solid Waste Disposal

Resource Management Issues

Water Supply
Consumptive Water Use
Lignite Reserve Depletion
Lignite RD&D Priorities
Utility Interconnection

Response Issues

(Policy Formulation)

Financing Community-Level Infrastructure
Control of Water-Quality Effects of Flow Reduction
Reducing Adverse Impacts of Reclamation on Wildlife
Control of Boom-Town Growth
Equitable Geographic Distribution of Lignite's Costs & Benefits
Control of Aesthetic Degradation

(Policy Implementation)

Approval of State Surface-Mining Program
Identifying Lands Unsuitable for Mining
Coordinating Multi-Agency Permit Review

In this final Chapter, these issues are again taken up and discussed in detail. The eighteen issues are grouped roughly according to the nature of their relationship to lignite development. These groups, shown in Table 1-1, consist of:

- Context-Setting Issues, resolution of which must occur principally at the federal level, and which affects overall rate and scale of lignite development;
- Resource Management Issues, directly or indirectly affecting the rate and scale of lignite development, and largely the responsibility of state government and/or private industry;
- Response Issues, which deal with the solution of problems attendant upon lignite development. This group is further divided into issues related to filling policy gaps and issues related to implementing existing policy.

Each issue is presented as a self-contained unit. A summary statement of the study finding which underlies the issue, and the issue itself, is followed by a table which details potential means of resolving it. The tables set forth one or more objectives which could be considered as guiding principles. These objectives may reflect the alternative values and goals of participating parties of interest. Alternative means of meeting these objectives are set forth, together with specific mechanisms of implementation. Implications of these alternatives are presented, as they relate to effectiveness, secondary impacts and acceptability.

The implementation of a policy of mandatory boiler-fuel conversion raises perhaps the most complex set of questions of any of the issues discussed here. Accordingly, it is given a much more extensive treatment, differing somewhat in format from that of the other issues.

The discussion of these issues is in no way intended to recommend any particular action. The analytical effort has been reviewed and critiqued by a panel of 30 selected representatives of various parties of interest. The intent of soliciting this review was to help focus this effort on questions of perceived importance, and to provide insight into the type of analysis most useful to decisionmakers.

2.0 CONTEXT-SETTING ISSUES

No. 1. Mandatory Boiler-Fuel Conversion (MBFC)

How can a balance be struck between the mutually conflicting objectives of clean air, economic efficiency and equity in fuel distribution, and import reduction?

No. 2. Ambient Ozone Levels

Should ambient ozone levels be found to be at or near the National Ambient Air Quality Standard, how can the state's goals of continued industrial growth be reconciled with the federal offsets policy?

No. 3. Control of Atmospheric Sulfates

How can forthcoming federal efforts to control ambient sulfate levels be directed so as not to impose an unnecessary restriction on lignite combustion at the mine mouth?

No. 4. Solid Waste Disposal

Will federal regulations regarding solid waste disposal adequately address Texas' needs, especially for aquifer protection, without severely inhibiting flexibility in selection of disposal technique?

These four "context-setting issues" all revolve around the development and implementation of federal policy. Key decisions will be made at that level; but a clear statement of Texas' position can be made through the Texas Congressional delegation and formal lobbying groups. Equally important is the development of working agreements between state and federal agencies in the administration of these policies. Resolution of these issues will affect both the rate and scale of lignite development, and major regionwide siting patterns. Consequently, they set the stage for most state and local activities relative to lignite.

CONTEXT-SETTING ISSUE NO. 1

Mandatory Boiler-Fuel Conversion

Finding: The increased use of coal and lignite resulting from mandatory boiler-fuel conversion (MBFC) appears to conflict with the goals of clean air policy. Also, the method of administering MBFC can materially affect the cost of conversion, both for individual industries and for the economy overall.

Issue: How can a balance be struck among the objectives of clean air, economic efficiency of fuel distribution, and import reduction? In particular, what roles can Texas play in achieving this balance?

2.1 Implementation of Mandatory Boiler Fuel Conversion

2.1.1 Summary and Conclusions

In view of recent very large additions to world oil and gas reserves, a mandatory fuel-use policy speaks more to the problems of continued fuel imports than to the conservation of scarce fuels. This is the approach proposed by ERA in administering the Fuel Use Act. Any effective policy to reduce imports involves an overall economic cost due to the increased costs of using substitute fuels. Issues arise both over the total costs involved, and over their distribution among regions and categories of users. Also, as coal and lignite are more widely used, conflicts develop with existing clean-air policy.

2.1.1.1 Alternatives to MBFC

Four major strategies for reducing fuel imports are discussed:

- Introduce artificial cost disincentives and incentives favoring domestic fuels (especially coal/lignite)

- Do away with present price controls and allow domestic fuel prices to respond to world prices

- Introduce import quotas or restrictions

- Reduce fossil-fuel use by substituting nuclear power, non-fossil technologies, and conservation.

The first of these may be variably effective, but complex market regulations may not result in the allocation of gas and oil to the most economically efficient uses. Unhampered, the market mechanism allocates resources efficiently, but may not reduce imports. Reductions in the world oil price by cartel action could actually raise import levels. Direct quotas are potentially effective controls on imports, and concurrent deregulation of the domestic market could allocate available fuels efficiently. To avoid major dislocations leading to fuel allocation or rationing, quotas might have to be instituted gradually.

Reducing fossil-fuel demand not only reduces import requirements, it involves none of the air-quality conflicts unavoidable in the other strategies. Of the various options, nuclear power offers the only short-term gains. Both conservation and new technologies require large investments to effect major reductions. Both because of the cumulative size of the investment needed and the time it takes to turn over stocks of capital equipment and housing, these options operate on a longer time frame. A possible exception might be cogeneration and improvements in industrial operation and maintenance procedures.

2.1.1.2 Resolving Conflicts Between MBFC and Clean-Air Policy

There are two aspects to the conflict between increased coal and lignite use and present air-quality policy. First, there are potential difficulties in fitting large amounts of mandated coal use under the present PSD and National Ambient Air Quality Standards. Second, and potentially more difficult, are possible future interstate conflicts arising over long-distance pollutant transport. Though not proven, evidence exists to suggest the possibility of issues developing over one state's emissions pre-empting growth in another state by tying up its "permittable" air resources. Considering Texas' size, long-distance transport could become a problem between regions within the state as well.

These potential long-term problems can be avoided entirely only by turning away from fossil fuels to a large extent. They can be delayed, however, by using the current air quality control program to reduce both the level of emissions and their density. These options, however, not only entail increased costs, they imply siting control over large areas. Under the proposed regulations for granting exemptions to the Fuel Use Act, which require alternative sites to be considered, there exists the potential for ERA to affect siting patterns indirectly. In so doing, it potentially conflicts with TACB and the PUC.

Thus, balancing MBFC with clean air policy appears to involve balancing the economic and strategic disadvantage of foreign fuel dependence against the potential disruptiveness of growth planning on a large scale. The dilemma could be avoided by relaxing air quality standards. However, to avoid possible later issues over long-distance transport, radical revisions of the concepts of PSD and fixed air quality ceilings would be needed.

2.1.1.3 Economic Efficiency of Fuel Allocation Under MBFC

The overall economic cost of a MBFC policy can be reduced by assuring that the controlled fuels go to the most economically efficient uses. The FUA and its proposed regulations, however, do not explicitly aim at efficient fuel allocation. A system of marketable entitlements, such as that proposed as an amendment to Texas Railroad Commission Docket 600, if adopted at the federal level, could be used to administer set levels of oil and gas reductions in an economically efficient way. Efficiency considerations could also be used in evaluating applications for exemption.

2.1.1.4 Texas Options and Concerns

As a state, Texas can do comparatively little independently to alter or replace current federal MBFC policy, although its public and private interests are expressed by its own Congressional delegation and by various lobbying groups. Under existing policy, state options are primarily in the supportive area, easing the economic impacts of the transition to coal and lignite through tax incentives, utility rate setting, and assistance to firms in obtaining needed front-end capital.

Texas has relatively more options for resolving the conflicts between MBFC and clean air policy. Here, it is important to avoid situations which might hamper mine-mouth siting of lignite-fired facilities. A variety of options exist for state agencies, in cooperation with ERA, to use emission controls and PSD management as a means to fit increased coal and lignite use into the present regulatory framework. Ultimately, however, such strategies should recognize the potential for future interstate issues over long-distance pollutant transport.

Although the state cannot initiate such a move, Texas would benefit by a change in administration of the Fuel Use Act that directly recognized the need for economically efficient fuel allocation.

Over the long term, substitution of non-fossil fuels for imports appears an attractive strategy, less economically disruptive than direct controls. Texas can act now to provide incentives for conservation, cogeneration, and new energy technologies, although very large effects may not be possible without the added push of higher prices. Gradual diversification of the state's energy mix would also stave off long-distance pollutant transport problems, and stretch out the state's supply of lignite.

2.1.2 Background and Context

As controversial as the whole idea of mandatory boiler-fuel conversion has been, it is extremely likely that both the Fuel Use Act and the regulations now proposed for its implementation will be subjected to intensive criticism as its effects began to be felt. Industry observers believe that final regulations similar to the draft proposed in November may go quickly into the courts.[1] Clear issues of interregional equity in sharing the costs of conversion are involved, in which Texas will surely take a part.

The background against which these controversies must be settled is one of vastly increased world gas and oil reserves and simultaneously rising U.S. oil imports. With the announcement of huge discoveries of natural gas in Mexico, and to a lesser extent in Canada, for which the U.S. is the only available large-volume customer, the pressure to conserve natural gas as a finite and dwindling resource is considerably lessened. The importance of controlling the U.S. balance of payments, as well as protecting national security in terms of fuel supply, however, is correspondingly increased.

The original Fuel Use Act was somewhat open-ended. Designed for an on-going process of administration through exemptions, it could have been used as a variable valve controlling the amount of natural gas and oil entering the national fuel mix. Had the principal goal merely been to conserve limited resources, exemption-granting could have been geared to respond to perceived changes in the availability of oil and gas. However, in proposing the tough stance inherent in the ERA's draft regulations, DOE has avowedly chosen to aim at oil import reduction. To a degree, it will be more acceptable to DOE to burn temporary oversupplies of domestic natural gas in boilers than to replace foreign-derived fuel oil.[2]

DOE takes its stand for energy independence, via the mechanism of MBFC, at a time when the nation is simultaneously committed to a clean environment and a strong economy with high levels of employment. While it is possible to reach a balance between these objectives, it is not possible to maximize all of them at the same time. The major policy conflicts connected with implementing the Fuel Use Act, especially between state and federal activities, arise when various groups attempt to attain one or more of these objectives at an optimum level.

In Texas, because of the central position of oil and gas in the state's economy, the conflicts between the three objectives are particularly intense. Meeting national energy independence goals may result in Texas' exporting more of its oil and gas for use outside the state. The result would be a fundamental shift in the energy economy of the state, affecting the cost of doing business in many economic sectors. At the same time, heavy pressure will be put on the state's limited strippable lignite. Increased burning of solid fossil fuels adds greatly to the general loading of environmental pollutants, and mining brings its own environmental impacts. The extra cost both of firing coal and lignite and of the required environmental protection strategies ultimately diverts capital from investments in increased production.

The following discussion outlines the three-way conflict between environment, economy, and energy independence as it affects actions to be taken both in implementing and adjusting to MBFC in Texas. Conflicts between increased coal use and air quality are first presented. Then, the economic effects of MBFC are discussed. Finally, specific alternatives available for resolving these conflicts are presented and evaluated.

2.1.3 MBFC and Clean Air

The principal air quality constraints that may be encountered in an effort to reduce gas and oil burning are those related to prevention of significant air-quality deterioration (PSD). Presently, PSD covers only SO_2 and particulates. Over much of the state, the entire legal increment is thought to be available for both of these pollutants. There are considerable areas, however, where the allowable SO_2 increment has been virtually used up at this date, and others where it is partially consumed. Siting coal-burning facilities in these areas may require offsets, or additional pollution-control equipment. Much of the large coastal industrial complex lies in such areas.

An additional problem is potentially posed by the emission of NO_x from coal burning. Much of the industrialized coast is now violating NAAQS for ozone. NO_x is a contributor to the formation of ozone, along with hydrocarbons. There is some controversy over the role NO_x control should taken in controlling oxidant problems in these areas.[3,4] In addition, EPA is required under the Clean Air Act of 1977 to promulgate PSD standards for NO_x.

It is apparent from the National Energy Act and the June 19 (1978) Regulations for Prevention of Significant Air Quality Deterioration[5] that both Congress and EPA intended clean-air requirements to be met at the expense of boiler-fuel conversion, if necessary. The NAAQS standards must be met or the SIP must be revised until they are. The new PSD increments are to be treated in the same way. Both temporary and permanent exemptions are allowed under the NEA for situations where coal use would violate applicable environmental standards.

The draft FUA regulations appear likely to attempt a compromise between clean air and boiler-fuel conversion by means of new-source siting patterns. The "Fuels Decision Report" accompanying any application for an environmental exemption must show consideration of alternative sites. Utilities must consider even sites outside their service territories. If the ERA carries through its promised tough stance on exemptions, the result may be a diffusion of new installations, forced to burn coal, away from coastal locations into areas where PSD increments are more readily available. Emissions, though high in total, will therefore be widely spread and have a reduced effect on ambient air quality.

It is possible for the ERA, through its approval of the review of alternative sites by applicants for environmental exemptions, to overlap the authority of the Texas Air Control Board in implementing PSD. The PSD increments, once defined, may not legally be violated. However, the states have considerable latitude in how they are administered. The increment can be expanded to accommodate growth based on use of dirtier fuels by requiring existing sources to control more stringently. Offsets may also be used to free up part of the increment to accommodate new sources. In addition, the states are encouraged to study and adopt a range of economics-based procedures for allocating the increment. Possible alternatives are marketable permits, emissions fees, and emission density zoning. In contrast to today's first-come, first-served practice of issuing permits, these methods confer a monetary value on emission control and are likely to pack more users into an available increment.

Utilities and industries may themselves become directly involved in the controversy over effective siting authority.

Already, Texas electric utilities have begun opposing one another, in normally routine certification hearings, over the use of the PSD increment. Under the draft FUA regulations, where utilities may be required to investigate sites outside their own service territories, this kind of conflict can intensify. When industrial coal and lignite users, unable to qualify for environmental or economic exemptions, also begin competing for the available increment, opposition to certification could increase even more. The PUC might thus ultimately find itself faced with secondary issues of economic growth outside its normal bounds of activity.

Without coordination between the affected agencies, the inevitable effects of the ERA's determinations on the pattern of increment use may lead to delay and conflict. Since the FUA makes no provision for administration by the states, direct federal-state coordination is called for.

The foregoing issues basically revolve around air quality problems at a local, or at the most multi-county level. Potentially much more difficult conflicts between increased coal-burning and air quality concerns appear at the multi-state level, where atmospheric transformation and long-distance transport of pollutants become important. Evidence exists which suggests that high sulfate and ozone levels in Arkansas sometimes contain a component which can be linked to emissions in the Gulf Coast, including Texas. Not only would increased SO_2 emissions contribute to such problems with sulfate levels, NO_x emissions, through subsequent atmospheric reactions, could add to ozone levels.* The net result could be that increased coal and lignite burning in Texas might contribute to partial or complete foreclosure of PSD increments (sulfates contribute to Total Suspended Particulates) and high or non-attainment levels of ozone in areas considerably downwind. Areas both within and outside Texas could be affected.

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*See Chapter IV, Section 2.0

Clear economic conflicts are involved. Should downwind states enact ambient sulfate standards, the contribution to ambient levels from out of state sources could become a serious legal issue.

2.1.4 Economic Efficiency and Administration of MBFC

Given that some level of fuel conversion is a national priority, the mode of its administration can have a potentially large effect both on the total cost to the economy of the conversion and how the cost is spread. In spreading the cost, equity is a concern. The total cost itself is related to the economic efficiency with which the available fuel mix is used. Considered over the entire economy, the cost is lowest when natural gas and oil, as the controlled resources, are allocated to those uses which produce the greatest economic return and/or provide the most jobs per unit used. With respect to this latter criterion of economic efficiency the proposed approach of ERA differs markedly from that of the Texas Railroad Commission in administering Docket 600.

Focusing only on natural gas, Docket 600 was based on the perception that natural gas should be saved for purposes to which it is uniquely well adapted, rather than burned indiscriminately as a boiler fuel. The basic idea is thus to allocate, more than to restrict, the use of gas. Oil is therefore considered an acceptable substitute.

Consistent with the concept of economic efficiency, it was proposed to implement the required reductions in gas use through a system of marketable "entitlements." Firms reducing gas consumption beyond the levels required by Docket 600 would be awarded credits, or "entitlements" to burn that much gas, which could then be applied to new expansions or sold to other firms. In this manner, firms making the most economically efficient use of the available gas would eventually be the ones using most of it.

At the same time, the entitlements concept had the effect of placing the use of natural gas, purchase of offsets, or purchase of pollution control equipment, on an equal footing as air quality control measures. A firm wishing to accommodate new growth within a PSD increment that is already partly consumed might buy either an entitlement, an emission offset, or pollution control equipment. All could be evaluated strictly in economic terms. The firm might choose the cheapest option, but air quality would be preserved in any case.

Although the entitlements provision has now gone by the boards, and in all probability will soon be followed by Docket 600 itself, it is of interest as one mode of spreading the cost of large-scale conversion away from one set of fuels and toward another. Any attempt to produce a boiler fuel mix other than what would normally develop under existing market conditions is bound to incur an economic cost commensurate to its effectiveness. The entitlements concept, by maximizing the economic efficiency with which the target fuel mix is used, tend to minimize the overall effect on the economy of achieving that target. It has the effect of raising the cost of gas use, so that firms unable to compete for it in this new circumstance must either find a substitute or curtail their activities. In this, the entitlements concept is inequitable with respect to existing users in the same way as a free market economy is inequitable.

The federal program, as tentatively fleshed out in the draft regulations for new boilers issued by ERA, differs from the state program not only in goals but in implementation. Avowedly aimed principally at curtailing petroleum imports, the proposed program is willing to accept a considerable economic and social cost in the process. This cost is reflected in the 30 to 80 percent handicap placed on oil and gas use by the provisions for granting economic exemptions. Where the Texas plan set its curtailment goals by specifying a direct volume reduction independent of the cost of achieving it, ERA has specified the acceptable cost, which will determine the actual amount of curtailment.

The proposed percentage cost handicap applies to all affected users, and is intended to force firms to accept the added costs of using coal. Not all firms will be equally able to bear these costs, however. In this respect, the federal approach differs little from the state's except in degree. Unlike the state's once-proposed entitlements concept, however, the federal program is not aimed directly at producing an economically efficient distribution of the ultimate fuel mix. Oil and gas will be allocated, by this process, to users with particular handicaps toward using coal, and who are thus exempted on the basis of significant hardship. These are not necessarily, however, the same users as would make the most economically efficient use of oil and gas. Firms capable of competing for entitlements would also, in principle, often be capable of supporting the costs of using coal. Under the federal program, many of these firms would fail to qualify for exemptions. Thus, the form of administration of the ERA program, even independent of its very high goals, may add an increment to the cost to the nation's economy of achieving those goals.

2.1.5 Alternatives to MBFC

Table 2-1 lists several alternative strategies by which the objective of reducing imports of foreign energy could

TABLE 2-1 REDUCE DEPENDENCE ON FOREIGN ENERGY IMPORTS

Alternative Strategy	Efficacy	Secondary Impacts	Equity	Implementability
1. Direct reduction of imports - quotas	Strict quotas very effective. Very strict quotas may also lower energy demand via higher prices for domestic products Affects all consumers of imports; future fuel choices of utilities least strongly	Domestic production of all fuels favored Much higher prices might aid commercialization of gasification and liquefaction	Windfall profits possible Higher prices across the board affect those least able to pay differentially. Efforts to protect these users also inequitable, and erodes conservation gains	In principle, straightforward; becomes more complex with efforts to deal with equity concerns, or to introduce by stages Must be initiated at federal level
2. Bring U.S. energy costs/prices into line with market forces **. Price decontrol for oil and gas** **. Crude oil equalization tax**	Potentially less effective in reducing imports, depending upon their price and the relative costs of using oil and gas vs coal Price increases may not be enough to spur large conservation efforts Affects all consumers of imports, future fuel choices of utilities least strongly	Deregulation favors domestic oil and gas production; coal may be less affected Taxation favors conservation Taxation approach diverts revenues from increased prices out of the private, energy-producing sector Prices unlikely to rise enough to favor gasification and liquefaction Efficient means of fuel allocation	Higher prices across the board affect users least able to pay; Tax approach offers means to subsidize these users, which erodes conservation gains Price decontrol may produce windfall profits	Decontrol may become complex if effected in stages Tax straightforward in principle, but rebates to some users produces complexities, increases administrative costs Decontrol eventually relieves government of administering burden of control. Must be initiated at Federal level
3. Offer financial/tax incentives for coal use **. Introduce price controls and tax incentives similar to those for oil and gas** **. Control escalation of interstate freight rates on coal** **. Tax incentives for coal conversion** **. Assistance in front-end financing for conversion**	Affects industry primarily. Coal price only part of the picture: capital and operating costs also higher than oil and gas. Prices would have to be very strongly controlled to overcome all potential cost disadvantages of coal. To be effective, tax incentives would have to overcome cost advantage of oil and gas. Front-end financing better suited to easing the impacts of mandated conversion than as an incentive to convert	Price controls might reduce coal production Control of freight rates might have a larger effect on western coals Lower coal prices might improve economics of synfuels	Differential effects on industries, unions directly affected by regulation	Price control, regulation of freight rates complex Tax incentives, front-end financing, complex to administer at effective levels Tax incentives, financing can be implemented at state level; all others require federal initiative

TABLE 2-1 (continued)

Alternative Strategy	Efficacy	Secondary Impacts	Equity	Implementability
4. Disincentives for oil and gas use (in boilers) . Mandatory boiler fuel conversion . Taxes, surcharges to increase the cost of oil and gas use . Incremental pricing (to industry) of new gas, LNG, imports	Affects only boiler uses; affects new industry more than utilities	Depending on the extent of the cost handicap on oil and gas, may hurt new domestic production Taxation approach diverts revenues from increased cost into public sector	Disadvantages boilers converted from coal to oil or gas Shifts costs of import reduction onto industry, utilities, and protects other users, thus eroding potential conservation gains	Administration of exemptions may be complex, controversial May be initiated at state or federal level
5. Reduce demand for fossil fuels . Provide incentives for conservation . Provide incentives for energy technologies based on non-fossil fuels . Remove barriers to rapid growth of nuclear power	Existing technologies capable of substituting for significant amounts of fossil energy Some new technologies not yet at a point for rapid commercialization Not all problems with nuclear are regulatory; e.g., delays, cost overruns	Positive effects on air pollution problems associated with fossil fuels Unknown impacts of non-fossil technologies Nuclear waste disposal may involve very long-term hazards Possible changes in life-style, especially regarding transportation	Front-end financing is a greater problem for some industries than others; may be a serious drawback for residential consumers Conservation induced by rising costs has proportinately greater effect on those least able to pay	Incentives and financial assistance sufficient to produce major changes would be highly complex and costly Incentives for conservation, new energy technologies may be taken at state or federal level Streamlining nuclear licensing procedure requires federal action
ALL OPTIONS		Requires increased capital investment without change in productivity Increased environmental costs Potential long-term effect on trends in industrial siting, mix of industries	Greater impacts on regions, users for whom oil and gas are most economically competitive, or where substitution is difficult	

be met, with specific methods of implementation. These strategies and, where appropriate, implementation alternatives under them, are compared with respect to their efficacy in meeting the goal of energy independence, secondary impacts of employing them, and equity concerns they raise. In addition, the alternatives are compared with respect to the potential ease of implementing them, along with comments regarding potential sources of support or opposition.

2.1.5.1 Common Features

All of the strategies listed entail certain common problems, which differ among them only in degree. Given that energy is now imported because it is more economically attractive to do so than to increase domestic production or change the fuel mix, any effective import-reduction policy will force energy consumers into less economical behavior. The resulting cost increases can be spread from the start among all consumers. However, these increases raise equity concerns, especially for residential consumers and the poor. The usual response is to distribute the direct increase in the costs of energy use differentially to utilities and industry, allowing smaller consumers to pay lower fuel prices.

Consumer product and service prices, however, eventually reflect increased costs to industry. Thus, the key question is not "who pays," but "in what way do we all pay." Because of the great complexity of the mechanism by which energy costs are translated into representative consumer cost indices, it is not possible to calculate directly the relative effects of the two approaches on inflation. Hence the issue tends to be handled largely in terms of political influence.

An aspect of the problem of cost distribution is the current interregional disparity in the costs of various fuels, and their proportion of use. Generally, producing regions like Texas and the Gulf Coast use more oil and gas than nonproducing regions. Thus, an attempt to adjust the fuel mix in an "equitable" manner involves levelling out these regional differences. Oil and gas producing regions inevitably experience the greatest impacts. Since gas and oil use for space heating and domestic uses has, under the historical pricing system, become widespread outside of producing regions, these impacts are worsened when efforts are made to protect the residential consumer.

The long-term erosion of the economic advantages of industrial location in oil and gas producing areas, coupled with growth constraints imposed by air quality protection, are likely to result in new national trends of industrial growth and siting. For Texas, these new trends are likely to be expressed not only in terms of total growth in heavy industry and its siting patterns within the state, but in the overall future industry mix. Developing conditions may promote a less energy-intensive balance of industries than the present mix, as well as favoring industries for which energy needs and emission levels pose fewer siting constraints.

Finally, any large-scale substitution of coal for oil and gas will increase the overall pollutant loading of the environment. The extent to which coal use is increased varies among the strategies, but all seem likely to involve a significant increase in our dependence on this very large energy resource.

2.1.5.2 Cost Control

The last two alternatives listed in Table 2-1, including mandatory boiler fuel conversion, operate by manipulating the cost of using energy. This can be done by providing both disincentives for using oil and gas and incentives for the use of coal. The various options listed differ considerably in their potential influence on domestic oil and gas production. Achieving independence from imports at the same time as increasing domestic production is a complicated matter if it is done through direct and indirect price manipulation.

To be highly effective in controlling imports, it is likely that a combination of strategies and options will be needed. The more extensive the regulatory effort, the more individual decisions and private interests are likely to be affected. Thus these options appear likely to accumulate opposition rapidly as their potential effectiveness increases. Conversely, a set of options likely to be both politically acceptable and fairly feasible to implement is also likely to be relatively low in effectiveness.

Again because of the complexity of such a package, its effects on the overall flexibility of the energy market, and its implications for inflation, are of potential concern. At the same time, they are very hard to evaluate. Two kinds of economic effect, however, are relatively easy to see. First, those options which use taxes to raise the prices of some fuels relative to others divert revenue out of the private sector and into the public sector. Second, since the market system is a very efficient mechanism for allocating resources, departures from it run the risk of producing allocation patterns which result in reduced economic return from the fuels used.

The relative amount of conflict with the current body of environmental regulation, particularly of air quality, depends largely on the amount of coal in the resulting fuel mix. Those options which favor domestic oil and gas production can be expected to involve less intense conflicts. No option, however, seems likely to result in complete replacement of imports with domestic oil and gas. Thus, air quality conflicts are not avoided, although more time may be made available in which to develop policy solutions before serious problems arise.

2.1.5.3 Market Allocation Mechanisms

The second alternative strategy would do away with the differences between world energy prices and the prices of fuels produced in the United States. This strategy has the advantage of resulting in an economically efficient distribution of fuels. Its effectiveness in reducing imports, however, depends jointly on the price of imported products relative to the cost of bringing additional U.S. energy reserves into production. Reduction of the world oil price by cartel action could result in continued or even increased levels of imports.

Two mechanisms are available to effect alignment of U.S. fuel prices with the world market. Complete price deregulation is the most direct. However, to avoid either excessive impacts from too-rapid deregulation or the administrative complexities of trying to deregulate slowly, the alternative method of simply taxing domestic energy to raise its price to world levels may be considered. Such a tax also captures windfall profits.

Like the taxation options in the cost-manipulation alternatives, an equalization tax diverts revenues from the private to the public sector. Also, it fails to encourage domestic production but instead encourages conservation.

To the extent that oil and gas -- either imported or domestic -- continue to be used, environmental conflicts are lessened.

2.1.5.4 Import Quotas

As a means of reducing dependence on foreign energy, import quotas are the most direct and (depending on the levels set) effective strategy. Import restrictions coupled with price deregulation would probably promote both conservation and new domestic oil and gas production. Coal production would be stimulated in response to rising oil and gas prices. In the absence of domestic price controls, the market would allocate fuels efficiently. At the same time, however, concern would be likely to arise over the rapidity of price increases, and their effect on the overall economy. To avoid major economic dislocations, rationing, and similar radical measures, it would probably be necessary to introduce import quotas in a stepwise, phased manner.

2.1.5.5 Reduction of Fossil Fuel Demand

The last-listed alternative strategy for reducing foreign imports--reducing demand for them--not only meets the immediate objective, but does so in a way that avoids the environmental conflicts that develop with the strategies that substitute domestic fossil fuels, especially coal for imports. Reductions can be accomplished by substituting non-fossil energy and/or by cutting down overall use of energy.

A key factor in any such strategy is the rate at which demand can be reduced. Of the three options listed, nuclear substitution can be implemented more quickly than either widespread, significant conservation or substitution of new "soft" energy technologies. Even though solar and solar-related technologies are available now, the Congressional Office of Technology Assessment[6] calculates that for solar to meet 10 percent of the U.S. energy needs, solar sales would have to grow by more than 50 percent per year for 20 years, and would require an investment of more than $500 billion. Very large advances in conservation are keyed to turnover rates in housing and large capital equipment, which typically have long operating lives. However, in the area of industrial energy use, cogeneration and improvements in operating and maintenance procedures could be introduced quite rapidly.

Demand reduction via conservation and new technologies can be brought about both by incentives--tax breaks, assistance in front-end financing--and by policies deliberately raising the price of energy. Although the first approach is more popular, it is the second which studies show may be most effective.[7,8]

2.1.6 Alternative Methods of Reducing Conflicts Between MBFC and Clean Air Policies

Given the present policy of controlling foreign imports through MBFC, effectively a substitution of coal for oil and gas, conflicts inevitably arise with existing clean-air policy. Table 2-2 compares four alternative strategies for reducing these conflicts. The first two strategies attempt to preserve the goals of both by adjusting the administration of current clean-air policy to reduce the adverse consequences of increased coal burning. The first focuses on the difficult interstate problem of long-distance transport, while the second deals with ambient air quality near the source. The third strategy requires the goal of clean air to take precedence over the goal of boiler fuel conversion. The fourth calls for air quality goals to be reduced in order to accommodate MBFC.

The first two strategies require complex interagency cooperation, in order to avoid problems of overlapping jurisdiction. Both strategies involve implicit regulation of new

TABLE 2-2 FIND A COMPROMISE BETWEEN MBFC AND CLEAN AIR GOALS

Alternative Strategy	Efficacy	Secondary Impacts	Equity	Implementability
1. Burn much larger amounts of coal, but with more stringent emission control Plant-by-plant emissions Tighter emission control requirements Require existing sources to reduce emissions Grants in aid of pollution control Areawide emissions Authority to require alternative sites to be investigated for all new sources Implement existing permitting authority to require minimum spacing between sources, otherwise control siting pattern	Both types of strategy may be needed to control long-distance transport problems Unless PSD increments are also revised, this strategy may only buy time; short-term gains in emission control offset by long-term increase in numbers of users	Higher utility costs, product costs Increased socio-economic costs of widely spaced growth of new sources, including potential water pollution problems Altered land values, land-use patterns Altered patterns of water demand Potential alteration of lignite use trends, if mine-mouth siting is limited. Coal sites are more flexible If done at state level only, may result in industrial growth going elsewhere along the Gulf	Tightening emission control requirements on existing sources may be unfair to "grandfathers," marginal operations. Can be partly offset by financial aid for pollution control Areawide emission control may imply regional allocation of population, heavy industry growth	Insufficient knowledge, modelling techniques to design and enforce a comprehensive strategy Areawide emission control requires ERA-PUC-TACB coordination Possible overlap with 208, basin planning All options may be implemented at state level, independent of federal action
2. Burn much larger amounts of coal, but with more intensive management of PSD increment . Set aside a portion of the increment for coal and lignite use; administer via offsets . Allocate the increment among user categories; administer through marketable permits	Does little to alleviate long-distance transport problems, unless coupled with tighter emission controls or emission density regulation Allows more users to occupy the available increment Encourages voluntary emission controls, especially through marketable permits	Higher utility, product costs Same socio-economic, land use, water demand impacts as above, but potentially more clustering, less spread of new sources	Special treatment of coal and lignite burning disadvantages other emitters Because of geographic differences in availability of increment, implies allocation of heavy industrial growth	May be implemented entirely at state level Likely to be very complex and controversial to administer. Marketable permits considerably reduce complexity

TABLE 2-2 (continued)

Alternative Strategy	Efficacy	Secondary Impacts	Equity	Implementability
3. Burn much larger amounts of coal, but relax air quality standards	Reduces cost of conversion, but reductions mainly in amount of emission control, leaving requirement for front-end costs of equipment May ultimately allow more heavy industrial growth	Increases potential air quality impacts outside Texas Allows more clustered development, especially if Gulf Coast zoned Class III Potential health risks Could result in acid rainfall, which in turn could lead to long-term losses in agricultural, forest productivity	Allowing PSD exemptions for converting sources penalizes those already converted	All but Class III redesignation must be initiated at the Federal level Altering existing NAAQS may preclude future regulations of sulfate standards Class III redesignations along the Gulf Coast may conflict with proposed wilderness designations in E. Texas, regulations in adjacent states Increases likelihood of interstate conflicts and litigation over pre-emption of available air resources or standards violation by long-distance transport of pollutants from Texas
. Increase PSD increments				
. Revise NAAQS (Ozone, TSP, SO_2, NO_x)				
. Designate areas Class III				
. Exempt sources converting to coal from consuming increment				
4. Burn less additional coal		Might promote industrial clustering in dirty-air areas, resulting in increased competition for PSD increments	Favors industries in dirty-air areas, penalizes states which have made most effective cleanup efforts	Alternative regulatory strategies for Fuel Use Act involve no major changes in implementability
. Eliminate alternative siting from Fuels Decision Report	Affects industry more than utilities			
. Reduce percentage handicap on oil and gas				
. Evaluate applications for environmental exemptions on the basis of long-distance transport phenomena	May increase number of exemptions to burn clean fuels	Requiring applicant to demonstrate long-distance impacts may be like 316a–no one tries it. This promotes use of coal with stringent controls, and possibly gasification.	Using long-distance transports as a criterion may imply regional regulation of heavy industrial growth	Insufficient knowledge or modelling capability to implement exemptions on basis of long-distance transport Utilities may experience conflict between discouraged coal use because of long-distance transport, discouraged nuclear use, and uncertain price/supply of oil and gas
. Allow rolled-in pricing for new gas	Likely to increase supply of gas, allowing MBFC to be aimed more directly at reducing foreign oil imports	May encourage commercialization of coal gasification	Favors high-priced domestic production, such as Alaskan gas	May prove complex to administer
. Allow imports of oil and natural gas, from diversified sources	Permits more clean-fuel use in the U.S. but spreads the security risk. Sensitive to cartel formation, behavior	Continued balance-of-payments problem	Does not protect residential users Does not support domestic production	Easily implemented

source siting and tend to relegate it to state agencies with previously narrower jurisdictions. Texas agencies are very unwilling to accept responsibility for developing or implementing a siting policy.

Both of the first two strategies use source spacing as a means of holding down air quality impacts. This approach, it should be noted, has a tendency to alter the overall pattern of environmental and socioeconomic impacts resulting from increased energy growth. The impacts of dispersed growth of utilities and heavy industry are more difficult to plan for than more centralized growth. Also, the total cost of providing additional services over a large number of communities may be somewhat higher. Difficulties in obtaining front-end financing for wastewater treatment, a pervasive problem among small communities, could result in at least temporary water quality problems. Against these negative impacts must be weighed the economic benefits to those areas into which industrial and utility growth is dispersed.

The third strategy is attractive as a means of easing the permitting and siting problems of boiler fuel conversion, and relieving some of the uncertainity involved in dealing with the current complex body of regulations. In the long run, however, it may exacerbate the problems of long-distance transport, and bring on the attendant interstate conflicts even sooner.

The fourth strategy admits of a variety of options for implementation. Two major choices exist: continuing to restrict both oil and gas use, but with higher ceilings; and allowing natural gas, rather than coal, to substitute for oil imports. The extent to which these options relieve the conflict with clean air policy depends on the proportion of low-sulfur oil and natural gas in the resulting fuel mix.

None of the four strategies offers a complete solution to the potential conflicts arising because of long-distance transport. The first and fourth strategies ease the problem's time frame, but may do no more than buy time in which to develop solutions.

At bottom, the tradeoff involved in meshing import-control and clean-air goals appears to be between the economic and strategic disadvantages of dependence on foreign energy sources, and the implications for the economy and society of growth management on a large scale. Avoiding this tradeoff seemingly requires allowing one goal to take clear precedence over the other.

2.1.7 Alternatives for Administering MBFC With Respect to Economic Efficiency

The proposed method of imposing a percentage handicap on the use of oil and gas is not directly aimed at promoting the most economically efficient uses of oil and gas. Table 2-3 shows two methods by which the existing policy could be administered with economic efficiency as an explicit goal. The first strategy is based on proposals to amend Texas' Docket 600, but which could be applied at the national level to the same effect. The second strategy reflects the philosophy of the Texas Railroad Commission in granting exemptions under Docket 600. In a precedent-setting early case, an exemption was granted on the basis of comparing the value of gas saved by mandated cutbacks with the value of production foregone because of reduced supply.[9] Subsequently, it was proposed, along with the "entitlements" strategy, that exemptions be granted on a showing that:

TABLE 2-3. ADMINISTER MBFC WITH RESPECT TO ECONOMIC EFFICIENCY OF ALLOWABLE GAS AND OIL USE

Alternative Strategy	Efficacy	Secondary Impacts	Equity	Implementability
1. Issue marketable entitlements to oil and gas use, with an overall limit on total use allowed	Very effective: works exclusively through the market system	Encourages conservation and conversion. If price of entitlements rises high enough, may promote coal conversion	Affords no protection to existing users	Easily administered, requires no adjustment to economic and fuel price changes Avoids problems with detailed regulations based on incomplete understanding of industry operations
2. Administer economic exemptions with regard to the relationship between the marginal value of gas or oil, the value of products produced, and the cost of conversion or cutback	Some cutoff point must be set, to assure some conversion; this method favors most economically efficient uses	Encourages improved efficiency in new designs Helps reduce total economic impact of conversion	Favors most efficient users	Initially difficult to devise a formula. Case-by-case implementation both complex and liable to inequities Open to problems with regulations based on incomplete understanding of industry operations

- The discounted present cost of alternative fuel usage is greater than the discounted present cost of the use of natural gas; and
- The marginal value of the product being produced through the use of natural gas is greater than the total value of the natural gas saved if the exemption is not granted.[10]

As proposed, these criteria would essentially permit exemptions wherever a substitute fuel was more costly to use. Since this differs little from the economic criteria normally used by firms in selecting fuels, very little conversion would take place. Thus, some penalty on oil and gas use, similar to the percentage cost test, would be called for to make such a policy effective. The new test, however, could be expressed in terms of the relationship of the marginal value of product to the increased cost of fuel substitution, rather than simply on the cost of substitution alone. This strategy would allow an advantage to more efficient users of gas and oil.

A problem with any MBFC implementation strategy is the risk of regulators not fully understanding the economics of industrial operation, and thus inadvertently proposing rules which increase the cost or difficulty of compliance. Examples have already arisen in the ERA's proposed regulations. ERA defines a new facility's life as 40 years, while the chemical industry usually considers a plant lifetime as 10-11 years, as allowed by the Internal Revenue Service. Similarly, the regulations propose using a discount rate of 7 percent in calculating alternative costs, while a more usual figure is 15 percent.[11]

2.1.8 Potential Roles for Texas

Because of the national scope of the problem, the most powerful of the alternative options for import control lie in the federal arena. The state's options are limited to those cost and tax incentives of Strategies 3 and 5 (Table 2-1) which make it easier to comply with national conversion objectives. It is within the state's power to institute disincentives for continued use of oil and gas which are stricter than federal policies. However, in so doing the state would place itself at a disadvantage with respect to other states competing for economic growth. The inclusion in Docket 600 of a phasedown in gas use for existing industrial boilers, where the Fuel Use Act has no such requirements, is a strong reason behind its probable abandonment. Thus, the principal mode by which Texas can promote changes in import-control policy will be through its Congressional delegation.

Given that Texas' major concerns are protecting domestic oil and gas production, continuing economic growth and reducing the discrepancies between Texas and non-producing regions of the U.S. in the cost of becoming more energy-independent, certain of the options in Table 2-1 are more attractive than others. Decontrol of both oil and gas prices is more compatible with both these concerns. Import quotas favor domestic production, but rising oil and gas prices and the potential need for fuel allocation would entail serious inter-regional inequities.

Conservation and substitution of non-fossil energy helps alleviate both concerns by reducing the state's dependence on fossil fuels. Furthermore, Texas can take the initiative in providing investment incentives and in financing early demonstration installations. Such action might help reduce industry's energy growth rate, and promote cogeneration. However, major short-term reductions in fossil fuel dependence require economic disincentives as well, raising the cost of continuing use of fossil energy. Again, the state would disadvantage itself by attempting to institute such policies, although it could do so.

More options are available to the State among the strategies of Table 2-2 in reducing conflicts between MBFC and clean-air policy. Most of the options of Strategies 1 and 2, which involve more stringent emission controls or specific strategies for allocating PSD increments, may be initiated at the state level. Redesignation of some areas as Class III to permit more coal-burning under existing regulations is also a state--actually a local--initiative. Implementation of either of the first two strategies, especially the first, requires extensive cooperation of state agencies among themselves, with federal agencies, and perhaps with parallel agencies in other states. Allowing either MBFC or clean air goals to dominate clearly, however, would require initiative at the federal level.

A major Texas objective in resolving MBFC/air quality conflicts will be to avoid restrictions on mine-mouth siting of lignite-burning facilities. Should clustering of power plants along the Lignite Belt be prohibited because of possible air quality impacts outside the state, the result would probably be increased use of western or midwestern coal. The coal-producing states would thus obtain the economic benefits of resource development which Texas would otherwise receive. Attempts to control area-wide emissions are potentially at odds with this goal; managing the PSD increments, however, may favor mine-mouth siting. A marketable permits strategy for PSD implementation, under Strategy 2, also tends to increase the potential number of facilities permitted within a given increment. These options, however, may simply trade one set of problems for another, if long-distance transport problems cause interstate air quality problems.

Those options under Strategy 4 which allow natural gas to substitute for oil imports are also potentially advantageous to Texas, in their encouragement of domestic gas production.

Both strategies presented in Table 2-3 are in line with Texas precedent of emphasizing economic efficiency in resource use. Texas would be likely to benefit more from these strategies than other regions where oil and gas use have not historically been as cost-effective. This would help relieve some of the inter-regional issues over the cost of implementing a national-level boiler-fuel conversion program.

CONTEXT-SETTING ISSUE NO. 2

Ambient Ozone Levels

Finding: Widespread high ambient ozone levels, at or near the National Ambient Air Quality Standard, may threaten long-term expansion of the chemical and related industries in Texas, which, in turn, would reduce the overall economic growth that ultimately drives lignite demand.

Issue: How can the state accommodate additional growth in these industries under the offsets policy for nonattainment areas?

TABLE 2-4 AMBIENT OZONE LEVELS

Objective	Alternatives	Implementation	Implication
. Adjust regulatory structure to accommodate new growth	. Channel new growth into attainment areas	. EPA proposing to raise to 0.10 ppm* . Additional health effects data may allow much higher level, if ozone is considered alone	. Uncertainty over statewide O_3 levels and extent of non-attainment may be higher than thought . Gulf Coast exerts a strong attraction for new growth because of existing transportation, allied and service industries, feedstocks, infrastructure . Penalizes industries which cannot relocate
. Accommodate new growth within present regulatory structure	. Change NAAQS from 0.08 ppm to a higher level*	. The combination of MBFC and non-attainment policy may force heavy industry to Lignite Belt . New growth can expand into attainment areas in Gulf Coast	. Fewer areas presently in non-attainment . Possible controversy over health impacts of other pollutants, formed with ozone, with effects at lower levels
	. Seek statutory or regulation change in non-attainment policy (Clean Air Act Amendments)	. Possible relaxation in non-attainment policy . Possible revision of criteria for NAAQS . Possible extension of deadlines . Define "reasonable further progress" toward NAAQS purely in terms of hydrocarbon emission reductions	. Direct method of solving the regulatory side of the problem . May allow greater actual air-quality impacts
. Make room for new growth by stringent emission controls	. Improved control technology	. RD&D into NO_x and hydrocarbon controls	. Effectiveness depends on proportion of natural vs man-made emissions
	. Successful transportation control strategy implementation	. Transportation controls . Vehicle operation and maintenance inspection program	. Stringent program effective, but expensive . Economic penalties hardest for the poor . Costs of strategy not paid by those who benefit directly

* In January, the NAAQS was raised to 0.12 ppm; measurement requirements were also changed

2.2 Ambient Ozone Levels

Fifteen counties comprising about 60 percent of the population and 70 percent of the economic activity in Texas have been designated by EPA as non-attainment areas (NAA's) for ozone or photochemical oxidants. It is believed that when air quality data are obtained for other counties, additional areas in the state will be found out of compliance with the National Ambient Air Quality Standard (NAAQS) for ozone.*

State leaders have expressed their fear that the federal policy for dealing with growth in NAA's (offsets) will lead to a stagnation in the growth of additional hydrocarbon-emitting facilities such as refineries and petrochemical plants. These industries presently account for more than three-quarters of the state's industrial energy consumption. If growth in these two sectors is curtailed, there will be less demand for lignite directly (boiler fuel for new facilities) and indirectly (less overall growth in the state).

Two basic strategies exist for coping with this problem beside continuing the status quo: altering the regulatory approach to ozone; and increasing control of hydrocarbon and NO_x emissions.

One way to live with the status quo is to encourage new growth in hydrocarbon-emitting industries to locate in areas attaining the ozone standard. One school of thought believes that non-attainment policy coupled with mandatory boiler fuel conversion will channel new industrial growth into the

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*On February 23, 1979, the Texas Air Control Board was officially informed by EPA that, because of the earlier revision of the national ozone standard from 0.08 ppm to 0.12 ppm, and changes in measurement requirements, only Harris County will face extensive offsets.

Texas Lignite Belt, creating a "Texas Ruhr Valley." Although this scenario is plausible, it overlooks the powerful economic affinity the oil- and gas-based industries have for the Gulf Coast area and for each other. The increased importation of foreign crude to Texas refineries, and the improved prospects of deepwater ports for supertankers, increase the advantages of a coastal location for refineries. Petrochemical plants are located near refineries and gas fields to be near feedstock sources. The Gulf Coast refining-petrochemical complex--which accounts for more than half of the nation's petrochemical production and more than one-fifth of the country's refining capacity--comprises a vast network of fuel, feedstock, and chemical intermediary exchanges. Expansion of these industries and the vast complex of service firms and related businesses is more likely to occur in nearby attainment areas along the Gulf Coast than in other regions or in other states. The key uncertainty here is whether additional monitoring, required for new-source permitting, might reveal these previously unstudied areas to be out of attainment, too.

One possible approach seeks relief from growth constraints through legislative remedies or regulation changes. The Clean Air Act requires states to demonstrate "reasonable further progress" in meeting NAAQS. If "reasonable further progress" were to be defined in terms of emission reductions of HC rather than ambient ozone levels, the prospects of growth curtailment would be diminished.

Recent changes in the ozone standard have helped relieve the non-attainment problem in the short term.. The basis of the change was given as recent medical evidence that suggested ozone was not damaging at levels well above the previous standard. However, ozone has been and continues to be regulated as a surrogate or indicator of other pollutants in the photochemical oxidants complex. These include respiratory and eye irritants such as PAN. There is a potential for controversy in the standard revision, that stems from the fact that if ozone is indeed an indicator of these other pollutants, increased ozone levels means that they will increase, too.

Another alternative rests on the application of stringent controls on existing emissions to make room for more. Cars and trucks are significant contributors to HC emission levels. The development of alternate mass transportation systems would reduce HC levels and mitigate other urban ills (as well as achieve conservation of energy). However, serious mass transit development, transportation controls and I&M inspection programs are not popular with Americans in general and Texans in particular. Hydrocarbons are not the only sources of ozone precursors. NO_x also participates in the reactions that produce ozone. EPA's present control strategy emphasizes HC more than NO_x; applying stronger controls to NO_x emissions would add leverage on the ozone problem. These options, however, have a disadvantage in that they are potentially very costly. Furthermore, the costs are not limited to those who benefit directly. Although reduced health hazards and continued prosperity are to everyone's advantage, the greatest economic benefits will accrue to only a portion of the state's industries and their employees.

CONTEXT-SETTING ISSUE NO. 3

Control of Atmospheric Sulfates

Finding: Sulfates formed downwind of coal- or lignite-combustion sources have potentially adverse effects on visibility and health, as well as contributing to acid rainfall and downwind particulate loadings. However, lack of knowledge of the mechanisms of these effects makes it difficult to define either an impact-related ambient standard or a control strategy that can be tied to meeting such a standard.

Issue: Faced with uncertainty, should a standard be set now ("better safe than sorry"), or be deferred until either more information is available, or a sulfate problem materializes?

TABLE 2-5. CONTROL OF ATMOSPHERIC SULFATES

Objectives	Alternatives	Implications
Reduce sulfate levels in the ambient air below the most conservative estimate of impact hazard.	Establish a sulfate standard for ambient air. (Montana has such a standard, at 4 $\mu g/m^3$. California's is 25 $\mu g/m^3$). Most conservative estimate of threshold for adverse health impact is 8-10 $\mu g/m^3$.	• Current estimated background levels exceed lowest estimated health threshold. • Present lack of a suitable control strategy to assure compliance. Implies costly trial-and-error regulation, possibly with requirements for retrofitting. • Benefits are difficult to quantify. • Uncertain influence of long-distance transport on current ambient concentrations; standard could prove impossible to meet. • Does not necessarily protect neighboring states from sulfates formed during transport in the atmosphere from Texas sulfur emissions.
	Limit SO_2 emissions at the source, through requiring universal scrubbing on all coal (EPA proposed revision of NSPS).	• Degree of control required to manage regional sulfate is not known. • Very high levels of removal (>85%) may be technologically limited. Backup systems might be needed, which would increase costs considerably for small increments of emission reduction. • Energy costs of scrubbing are high--for 90% removal, 3.8% of plant's power output may go to the FGD system. • Although new source emissions are effectively controlled, existing or "grandfathered" sources, uncontrolled by NSPS, may emit large amounts of SO_2.
		• Potential problems of administration if revisions are required to achieve ambient sulfate levels that are below conservative estimates of health risk. Retrofitting existing sources might be required.
	Reduce areawide emission levels. • Through implementation of PSD - smaller increments of SO_2 allowable	• Probability of siting problems. Distribution of environmental and social impacts. • Potential deficiencies in site availability, which could force greater use of oil or gas. • Difficulty obtaining offsets in remoter areas once increment is used up.
	• Through emission density zoning	• Effectively provides land use constraints that can markedly affect property values, taxes, etc. (Note relationship to recently passed Constitutional amendment.) • Potential administrative difficulties if no "beneficial use" or "diligence" requirement is attached to an "air right." • Considerable potential inequity arising from tendency of air rights to become marketable commodity, held by firms for which the value of emissions (or "air use") is high with respect to the value of products produced. • Very economically efficient means of controlling regional emission densities.

TABLE 2-5. (continued)

Objectives	Alternatives	Implications
Reduce sulfate levels in the ambient air below the most conservative estimate of impact hazard, as soon as possible. (continued)	Massive conservation of fossil fuels . Through energy conservation at the end use	• Extensive federal intervention likely to be needed if large reductions in fossil use are to be effected. • Potential financing difficulties (see Chapter I for discussion).
	. Through requirements to use natural gas or synthetic gas from coal or lignite	• Lower efficiency of energy use when synthetics are used. • Uncertain economics of synthetics • Uncertain price and supply of natural gas • Increased coal production. } Potential significant economic costs. Potential requirement for subsidies. • Added inefficiency and inequity in the national energy market.
	. Through increased nuclear power development.	• Substituting the uncertainties surrounding nuclear waste disposal for those surrounding sulfates is replacing one problem with another. • Public unwillingness to accept high nuclear growth
Determine an acceptable level and define control strategy before regulation, so as to avoid potential waste of effort, many administrative difficulties.	• Defer sulfate regulation until standard can be defined based on cause-effect relationships and an effective control strategy identified by which compliance may be assured.	• Sources permitted in the interim, and existing sources might have to be retrofitted with extremely stringent controls, with serious--and relatively sudden--economic consequences. Compromise could pit economic values against measurable health and ecological risks in a very direct way. • There is no way to retroactively alter siting patterns should this be shown to be a necessary element of a strategy to control interstate pollution problems. • Risk of adverse health and ecological impacts in the interim.

2.3 Control of Atmospheric Sulfates

Sulfates formed downwind of large combustion sources are thought to contribute to a variety of problems. Recent research suggests that adverse health effects once attributed to SO_2 may actually be caused by sulfate particles. Sulfate particles in the air also contribute to visibility problems, and can add to the baseline TSP loading, relative to PSD increments,* many miles from the original combustion source. The oxidation in the atmosphere of SO_2 to SO_4^{-2} also results in the formation of H_2SO_4, one of the primary contributors to rainfall acidity.

The 1977 Clean Air Act Amendments require EPA to develop visibility standards for Class I PSD areas, which involves considering sulfate impacts on visibility. EPA is also required to study the effects of sulfates on human health and welfare. The eventual outcome may be an attempt to regulate the air quality impacts of sulfates. A workshop sponsored by Brookhaven National Laboratory in 1977 suggested that a national ambient standard for total water-soluble sulfates might be feasible within one to two years, based on the status of measurement techniques.

Sulfate standards, and associated control requirements, could have important consequences for Texas lignite. First, very stringent requirements could limit the use of both oil and solid fossil fuels. Second, evidence has been published to suggest that, at least in more humid areas of east Texas, ambient levels are already high relative to existing standards in other states.* Such conditions could greatly hamper mine-mouth siting. Even if standards are not already exceeded, siting could be affected by strategies aimed at controlling areawide emissions.

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*It is here assumed that the reader is familiar with the Prevention of Significant Deterioration policy set forth in the Clean Air Act Amendments of 1977. Those wishing further information are referred to Chapter IV, Section 2.0.

In order to derive a standard that is both appropriate and enforceable, it would be necessary to have considerable certainty regarding:

- The chemistry of sulfate formation in the atmosphere, permitting the relationship between SO_2 emissions and downwind sulfate levels to be modeled.
- Ambient sulfate levels that cause damage of various kinds, including the ability to relate SO_2 emissions quantitatively to acid rain.
- The quantitative relationship between costs of controlling sulfate formation and the benefits resulting.
- Accuracy of methods of monitoring harmful species in the air.

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*For reference, a recent study by the University of Texas Center for Energy Studies cites the Texas Air Control Board as the source of data used in an estimate of ambient sulfate aerosol levels of about 20 $\mu g/m^3$. By comparison, the Brookhaven workshop suggested a range of 5-15 $\mu g/m^3$ (annual average) as a feasible near-term standard for total water-soluble sulfates. Montana now has a 4 $\mu g/m^3$ standard, and California has a standard of 25 $\mu g/m^3$.

None of these three key areas is well enough developed today to permit a standard to be derived (from cause-effect relationships), or to allow compliance to be determined with accuracy.

This lack of understanding of cause-and-effect linking SO_2 emissions to ambient sulfate standards means that such standards, promulgated now, would have to be asserted rather than proved. In such a case, both precursors (SO_2) and derivatives (sulfates and, more inclusively, TSP) would be regulated with regard to their separate environmental effects, but not their relationship to one another. It would be a matter of luck if a first try, made necessarily in at least partial uncertainty, hit on an ambient level for sulfates that could be achieved consistently with existing standards.

One approach to the problem would be to set a conservative standard, on the grounds of "better safe than sorry." Considering the powerful factors favoring the use of lignite at the mine mouth, the consequences of a stringent sulfate standard could potentially curtail lignite's future. It is possible to envision a scenario in which plants initially permitted with respect to existing SO_2 standards were subsequently implicated in failure to meet sulfate standards (or related visibility or respirable particulate standards) downwind. Unable to relocate, these plants might have to reduce their SO_2 emissions. Considering the economics of sulfur removal at levels above 85 percent, it is reasonable to expect this type of adjustment to be costly. Further mine-mouth combustion at new sites might prove cost-ineffective. If at that time, lignite transportation away from the mine were still cost-ineffective, coal might be substituted for what would otherwise been increased use of lignite. Purchasing coal from outside the state is considerably less beneficial to the state's economy than mining and using native lignite. Also, as was mentioned in the preceding discussion of

MBFC (Context-Setting Issue No. 1), it may prove necessary to regulate source spacing as well as SO_2 emissions to exert the needed leverage on sulfate levels.

At the other end of the scale, waiting too long to introduce some control on sulfates until all the requisite knowledge is available at an acceptable level of certainty runs the risk of seeing a sulfate problem materialize before we are ready for it.* This outcome would bring with it the same kinds of disadvantages just pointed out. If retrofitting is considered an acceptable way of dealing with the problem, waiting until the problem develops is a way of being more certain about permissible emission levels. This argument is strengthened if the likelihood of strong variability between different parts of the nation, with regard to the rates of atmospheric chemical reactions and the processes of rainfall acidification, are taken into account.

The basic choice to be made in the resolution of the sulfates question is whether to regulate now, with the risk of over (or under) regulation, or to wait until sulfate standards can be matched with SO_2 emission standards and PSD policy for both SO_2 and TSP, as part of an integrated package.

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*One conservative modeling study[11] concluded that sulfate levels as high as 35 to 45 $\mu g/m^3$, under worst-case conditions, could develop in east Texas by 1985.

CONTEXT-SETTING ISSUE NO. 4

Solid Waste Disposal

Finding: Considerable volumes of solid waste will result from combustion of lignite in Texas. The development scenario indicates that most of this waste, if disposed of on or near the plant site where it was generated, would be impounded in areas where groundwater contamination could occur if adequate care were not taken. The chemical composition of ash and scrubber sludge could also result in their being designated as hazardous under EPA's proposed testing procedures.

Issue: What should state and federal regulations require to assure protection of aquifers without severely inhibiting industry's flexibility in developing economic means of disposal?

TABLE 2-6. SOLID WASTE DISPOSAL

Objectives	Alternative	Implementation	Implications
Balance aquifer protection with disposal cost considerations	• Encourage recycling/reuse of wastes	• Encourage R D&D into technologies, markets • Classify wastes as non-hazardous • Revise state highway and building construction standards to allow use of ash	• If wastes hazardous, difficult to find acceptable uses without treatment • Reduces disposal costs, affected land area • Requires improved technologies • Depends on available markets
	• Revise NSPS to allow coal burning without scrubbers	• EPA determination in favor of sliding scale scrubbing based on sulfur content of coal in promulgating revised NSPS for fossil-fuel fired steam electric generators	• No effects on lignite SO_2 control standards • Stimulates demand for low sulfur coal • Higher utility costs for fuel compared to lignite • Possibly lower cumulative SO_2 emissions
	• Classify wastes as hazardous but specify lesser requirements	• Establish special hazardous waste category for utility sludge under RCRA	• Provide more administrative flexibility • Tailors controls to particular waste • Balances cost and protection needs
Hold down disposal costs under RCRA	• Mine disposal	• Develop special standards for mine site disposal in federal and state regulations • Encourage additional research and analysis	• Possible ground and surface water contamination • Inhibit proper reclamation • Reduce land area disturbed by lignite development • Ample availability of sites • Reduce land acquisition costs and disposal costs
	• Classify wastes as non-hazardous under RCRA	• EPA determination under RCRA that utility wastes not hazardous	• Lowers disposal costs • Encourages recycling of wastes • Increases chance of ground and surface water contamination through less stringent standards
Implement RCRA with specific emphasis on groundwater protection	• Use of lined disposal ponds, leachate collection systems, under-drainage systems, etc., to ensure maximum protection	• Revise state and federal regulations to require liner, leachate collection system, under-drainage system as standard	• Reduces contamination potential • Increases disposal costs • Employs available technology and materials
	• Pre-disposal waste treatment	• Revise state and federal regulation to encourage/require pretreatment • Encourage R D&D	• Reduces contamination potential • Lower initial disposal costs • Imposes treatment costs

2.4 Solid Waste

Concern over the disposal of power-plant ash and sludge runs high in Texas, both because increasing coal and lignite use means large quantities will be generated, and because solid waste disposal is a relatively new regulatory area. There are a variety of ways of handling solid waste to restrict its potential to contaminate the surrounding environment. The solid waste issue does not, therefore, center on the question of whether serious contamination problems can in fact be prevented. The key questions are, rather, over the classification of wastes and the standards of practice set for their disposal. Developing such regulations involves finding an acceptable balance between environmental protection and disposal cost.

A degree of uncertainty is added to this process by the difficulty of evaluating the relationship between waste disposal and sub-surface hydrology. In Texas, ground-water recharge and movement is generally complex and highly site-specific. Thus it is difficult to establish general standards of disposal practice that are well suited to all possible situations. Lack of regulatory flexibility to designate disposal practices appropriate to each site could add to the overall cost of environmental protection.

Two policy areas are currently under development by the Environmental Protection Agency which will affect the outcome of the solid waste issue. In September of this year, EPA proposed a revision to the New Source Performance Standards for Fossil Fuel Fired Steam Electric Generating Plants under the Clean Air Act, which would require full scrubbing on all coal-burning facilities regardless of the sulfur content of the fuel. Final administrative determination of this policy will not occur until

1979. EPA is also in the process of issuing regulations under the Resource Conservation and Recovery Act of 1976. A key question in the development of these regulations is whether ash and scrubber sludge generated by power plants will be classified as hazardous wastes and, therefore, subject to the provisions of subtitle C of the Act. If not regulated as hazardous waste, scrubber sludges will fall under subtitle D regulations which address non-hazardous wastes.

EPA proposes to list utility solid waste from air pollution devices as a hazardous waste to be regulated under subtitle C, but will place it in a special category of high-volume waste. Storage, treatment and disposal requirements are still under development, and only minimal requirements would apply in the interim. In either case, the long-term implication of the Resource Conservation and Recovery Act is to increase the costs of disposal, strengthen the site-selection requirements, and reduce the overall flexibility of utilities in selecting alternative disposal techniques and practices.

The lignite-bearing strata in Texas are hydrologically connected with major aquifer systems. The Carrizo-Wilcox aquifer system is particularly important. It runs from northeast Texas in a southwesterly direction into south Texas. It is characterized by irregular outcrops of sands which serve as the recharge areas for the aquifer. Because utilities customarily site disposal facilities within a mile or so from the power generation plant, there may be a long-term problem of finding suitable sites not located in recharge areas that would also be in close proximity to a desirable power plant generating site.

Mine disposal of solid waste is an economically attractive option, especially for facilities sited next to strip mines.

However, the environmental problems in mine disposal are numerous. One problem is the disruption of the hydrologic system which occurs during the mining process, making it more difficult to predict with accuracy the hydraulic movement of sludge leachate from solid waste disposed of in a mine site. Linings or placement of impermeable material to retard leaching would directly interfere with mine hydrodynamics, and in many instances create conditions very different from those existing before mining. Thus, the aquifer-protection provisions of the Surface Mining Control and Reclamation Act may preclude mine disposal.

3.0 RESOURCE MANAGEMENT ISSUES

No. 1. Water Supply

How can adequate supplies of water be made available for energy growth at reasonable cost and without undue conflict between water users?

No. 2. Consumptive Water Use

How can increasing power-plant cooling water consumption be kept from placing an undue burden on water supply management?

No. 3. Lignite Reserve Depletion

Is it in Texas' best interest to allow the strippable lignite resource to be committed largely to combustion uses?

No. 4. Lignite RD&D Priorities

How should research efforts be spread among existing technologies and developing technologies?

No. 5. Utility Interconnection

Would interconnection of the Texas Interconnect System with the interstate grid result in export of lignite-produced electricity?

The five issues discussed here involve decisions about the allocation and rate of development of water and lignite resources. Supplies of both are limited and many potential users compete for them. This competition will grow more serious with time. Decisions regarding the development of both resources are interrelated, and are ultimately reflected in the role lignite plays in the state's economic and environmental future. These decisions take place at both the state and the federal level, and may involve resolution of conflicts between differing state and national objectives.

RESOURCE MANAGEMENT ISSUE NO. 1

Water Supply

Finding: Unless the development and allocation of water resources is properly coordinated and planned, there may be difficulty in supplying the water requirements of the development scenario.

Issue: How can water development and allocation be managed so as to balance the needs of energy development with those of other users?

TABLE 3–1 WATER SUPPLY

Objective	Alternative	Implementation	Implications
Assure timely development of surface water for lignite development	Construct new main stem impoundments	• Federal funding and construction • Increased state/local financing & construction • Private financing and construction for industrial water supplies	• Large surface impoundments are a key element of forecast water supplies • Larger numbers of smaller projects may be less water-efficient • Aesthetic and ecological impacts lead to environmental opposition • Conflicts between users in upper vs lower portions of basins • Rising prices disadvantage some existing users • Conflicts over alternative use of reservoir sites, especially where underlain by lignite
	Interbasin transfer	• Authorization & construction of reservoirs & interbasin transfer systems (e.g., Lake Livingston)	• Gets water from regions of high supply to high demand • Disrupts basin hydrodynamics • Large-scale diversions may have significant energy demand • Increased competition could affect value/price of water in basins from which diversions made • Conflicts between beneficiaries & basin-of-origin users • Rising prices disadvantage some existing users
Protect beneficial surface-water uses which cannot compete at higher water prices	Subsidize identified uses (agriculture, municipal use)	• Price new water supplies with respect to economic efficiency of use • Provide financial assistance from public monies for qualifying uses "in the public interest"	• Will not necessarily affect pressure to sell existing water appropriations as value goes up • Subsidizing cost of water for some users raises price for others; this increase may affect a variety of product prices • Helps produce a more even distribution of water among competing users • Results in less economically efficient water distribution overall • Complex administration likely to result in many case-by-case conflicts
Protect existing groundwater uses from drawdown and quality deterioration	Control pumpage rates on an aquifer-wide basis; coordinated surface and groundwater management	• Establish state groundwater management authority • Require the formation of Groundwater Conservation Districts in designated aquifers	• Depending on implementation, may be very effective tool for preventing untimely depletion and/or irreversible degradation of groundwater • Has potential to affect land-use and economic growth patterns • Would require establishment of priorities for beneficial uses in which an equity/efficiency balance must be struck • Conceivably could work hardship on some existing users

TABLE 3-1 (continued)

Objective	Alternative	Implementation	Implications
Protect existing groundwater uses from drawdown and quality deterioration (continued)	Control pumpage rates on an aquifer-wide basis; coordinated surface and groundwater management (continued)	Limit large-volume industrial use of groundwater Direct some industrial uses to deep or poor-quality aquifers	Protects against major local problems, but does not afford widespread protection to groundwater users Limiting industrial use places greater demand on surface water, which through increased competition and higher prices may displace other potential surface demand onto groundwater Potential limitations on industrial siting Limiting groundwater sources for industry will increase the cost of supply Produces less economically efficient distribution of groundwater to users Spreads available resource more evenly among potential users
Reduce competition for surface and groundwater by increasing efficiency of use	Free-market pricing of new water supplies	Conditioning of federal funding of large water projects Increased state share of funding	Depends on price increases that result, and elasticities of demands. Does not affect use of existing supplies May reduce environmental, resource-use conflicts over reservoir building May lengthen water planning horizons if use reduction is significant Some users will be penalized more heavily than others by higher prices May result in more economically efficient allocation of total water supply
	Incentives/controls to conserve water	Conditioning of water appropriations & contracts Publicly funded financial assistance for capital investments in conserving technologies (especially to agriculture) Mandatory establishment of Groundwater Conservation Districts to control pumpage and limiting non-essential uses	Gains likely to be small, compared to overall growth in water demand, except in agricultural sector May lengthen water planning horizons, if use reduction is significant Agricultural users have great conservation potential, but may be least able to pay or change current practices May result in more economically efficient use of total water supply Postpones need for developing new supplies and attendant higher costs

3.1 Water Supply

As was discussed in Chapter IV, Section 4.0, water will be made available for energy through three routes: additional surface development, transfer of existing water rights, and increased use of groundwater, either directly or indirectly through displacement of competing surface-water demands. The balance among these three routes is determined by a host of factors, and is liable to change with time. No one of these routes is without impediment, and all three involve questions of impact mitigation, discussed in Chapter IV.

A key aspect of the balance struck among the three is the equitability and economic efficiency with which available water is allocated. Equity concerns relate to the protection of existing water users from being rendered incapable of continuing to use water as they have in the past. This can arise because of increasing prices, drawdown of wells, and changing regulatory practices concerning water rights. Economic efficiency refers to the amount of economic benefit--jobs, value added, etc.--accruing to the use of water. Existing use patterns are very often not the most economically efficient. Consequently, equity and efficiency concerns tend to oppose one another and must be reconciled.

3.1.1 Surface Water Development

The Texas Department of Water Resources (Water Development Board) plays a central role in planning the development of surface supplies. It cooperates with federal agencies and acts as state sponsor of federal projects when no suitable local agency is found. In addition, independent River Authorities, with the status of state agencies, plan, finance, construct, and operate large storage projects on most of the Texas' intrastate streams. River Authorities can receive loans and grants from the federal government, and can issue bonds. Revenues from the sale of water or electric power ultimately pay for water development costs. Other local government bodies--counties, cities, and special water districts--are also empowered to conduct various water programs. The federal agencies chiefly involved in funding and/or constructing large projects are the Army Corps of Engineers and the Bureau of Reclamation. However, of 63 large reservoirs in Texas, only 28 are federally owned or operated. Thus, water development in Texas can involve the entire spectrum of government from federal to local agencies.

Several constraints upon developing additional surface water supplies are developing as a result of emerging policy, as summarized below.

- Trend toward federal deemphasis on reservoir construction. Major elements proposed by the Water Resources Council for a national water policy include
    - Emphasis on non-structural alternatives to flood control (flood plain management). This trend is already evident in the National Flood Disaster Protection Act of 1973.
    - Increasing the price of water to users
    - Requiring more state participation in federally funded projects
    - Proposed changes in calculating costs and benefits

  - The recent presidential veto on reservoir appropriations also reflects this trend

- Federal requirements for provision of "mitigation lands" for lost wildlife habitat.

  The federal government is pushing the concept that developers of reservoirs which destroy wildlife habitat must purchase a public habitat preserve to mitigate the loss. Even when funding for habitat-loss mitigation is not part of the original appropriation, this is a condition for obtaining a Corps of Engineers permit.

- Diffuse surface water impoundments.

  - Private landowners presently may establish impoundments upon public watercourses for livestock or domestic purposes without a permit, as long as the reservoir does not exceed 200 acre feet.

  - TSPE* studies indicate these stock ponds typically impound much more water than is actually needed. These ponds number in the hundreds of thousands, and collectively account for evaporative losses of significance to water planners.

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*Texas Society of Professional Engineers. Cited in McNeely and Lacewell, 1977.[12]

- Barriers to state financing
  - In 1977, state voters rejected increasing the state's water-development bonding authority from $400 million to $800 million. With increased voter concern over cutting taxes, large public expenses will be subject to increasing scrutiny, and bonding increases made more difficult.
- Environmental opposition.
  - Aesthetics (scenic stretches of rivers may be impounded)
  - Loss of valuable and limited bottomland and riparian habitat
- Requirements to maintain estuarine inflows in order to sustain ecosystem productivity. Requirements have not yet been quantified, but may add to the overall need for surface water development.
- Resource use conflicts. Issues arise over:
  - Inundation of farmland
  - Inundation of minerals, including lignite
  - Removal of tax-producing property

The problem of resource-use conflicts is dramatically illustrated in the case of the proposed Tennessee Colony Reservoir on the Trinity River west of Palestine. The reservoir site is underlain by substantial lignite deposits posing the question of:

- Will the Surface Mining Control and Reclamation Act effectively preclude mining in major floodplains?

- Should the lignite be extracted prior to reservoir construction, or should the area be inundated, thus precluding mining of the lignite altogether?

- What should be the reclamation requirements for a lignite mine intended for later inundation as a major reservoir?

- How are conflicts to be resolved between ownership or leasehold interests in the surface estate and in the lignite?

3.1.2 Equity and Efficiency in Water Allocation

Surface water users are protected by a system of legal rights which assure continued enjoyment of rights once granted. New rights must be granted, and new projects planned and operated, in such a way as to avoid interference with existing water rights.

However, much of the additional surface water supply made available for use will be impounded in large reservoirs. The rights to this water are assigned to the developing agency, such as a river authority. The developer then sells the water on contract to potential users. The price of water is usually set so as to recover the cost of building and operating the project. Because of a variety of economic and engineering factors, these prices are rising fast; water in existing reservoirs may sell for $15 per acre-foot, while in some new impoundments, the price may be as high as $75. As was pointed out in Chapter IV, Section 4.0, agricultural interests may not be able to compete at such prices.

Most agricultural uses are not as economically efficient as manufacturing or industrial uses, including power generation.* Thus, rising prices may, by shifting water into the hands of the more efficient users, who can pay more, increase the efficiency with which the overall supply is used. Agriculture, however, is a major economic activity in Texas. A decline in agricultural growth or activity, related to higher water prices, would be widely perceived as inequitable.

Groundwater users have virtually no protection at present. Groundwater is considered a property right, and surface owners are permitted to withdraw water from beneath their land without constraint. By the Right of Capture principle, groundwater pumping may legally draw down water levels in adjacent wells. This situation is likely to become more common as groundwater substitutes to a greater degree for expensive new surface water supplies. Large well fields, withdrawing water for industrial or power-production purposes, can have a significant local effect.

Legislation has been introduced in the Sixty-Sixth Legislature which proposes to establish a marketable groundwater right that could be transferred by sale to more economically beneficial users. The proposed legislation would amend existing groundwater law by conferring a property right to surface owners for the water underlying their land. The Right of Capture principle that allows unlimited groundwater withdrawal would, in effect, be replaced with a property right subject to legal protection and to sale by the owner of the surface estate.

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*Detailed analyses of the economic impacts of water use by major economic sectors, based on input-output analysis, are given in the TDWR document, Continuing Water Resources Planning and Development for Texas, 2 Vols., Austin, Texas, May 1977.

3.1.3 Water Conservation

Problems of supply and allocation can be reduced in intensity, and planning given a longer horizon, by measures which cut down on water waste. Water reuse has already begun to expand in industry, under economic pressure. Especially for individual large users, recycling and reuse can produce significant economic benefits. Consequently, those basins where manufacturing is a dominant water use may be in a better position to adjust to lignite-related increases in water demand than other basins. Potentially large water savings can be realized in agriculture through existing technology. Use patterns in the agricultural sector, however, especially in irrigation, are harder to shift than industrial ones. This is so in large part because of the large capital expenditures required for equipment. Individual farmers and ranchers may have more difficulty financing newer, water-saving technologies than industrial operations. Municipal demand is very difficult to curtail, largely because there are few opportunities to conserve enough water to have basinwide significance. Also, many individual household decisions are needed to produce a measurable demand reduction.

Conservation is one of the key concepts embodied in the Water Resources Council's proposals for a national water policy.* The Council saw pricing as a key mechanism to force conservation. Large enough price changes, however, can also lead to a net shift of water supplies out of agriculture and into more economically efficient uses. Thus, pricing may be a very difficult stimulus to calibrate.

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*Federal Register, July 15, 1977, Part VI. These proposals met with substantial opposition, particularly from water-short states, and subsequent action has been delayed.

3.1.4 Leverage on the Water Supply Issue

Because the general water-supply issue has so many facets, a variety of federal and state entities can exert leverage upon it to varying degrees. In general, however, the state legislature and water agencies appear to have the central responsibility for water planning decisions.

The state, through the Water Development Board and the River Authorities and other local water agencies, can take a greater role in water development, as federal participation slackens. To do so, however, requires a resolution of the conflicting attitudes which produced the recent defeat of proposals to extend the state's financial base for water projects. Contract water prices are set by those agencies developing supplies, which are very often state bodies. If the state takes on a greater role in development, a greater portion of the new contract water supply will be priced in this way.

Major reforms in water management, which could permit groundwater to be managed jointly with surface water, and/or give protection to groundwater users, would require action by the state legislature. Based on existing state water policy alone, the outlook for systematic, basinwide planning, conservation, and allocation of water supply appears unpromising. Countervailing doctrines are firmly entrenched in state water law and reinforced by practice. Current federal efforts to establish an updated, uniform water policy could conceivably break the impasse by mandating state legislative reform. A thorough analysis of the implications for Texas of the policy options developed by the Water Resources Council is both premature and outside the scope of this study. However, it is clear that their emphasis on modern, hydrologically sound planning could clear the way at the state level for substantial improvements in water management. Such policy recommendations, however, will have to overcome strong objections.

Conservation could be encouraged by both federal and state action. As is true with energy, conservation can be effected both through disincentives for use--such as price increases--and incentives for conservation--such as tax credits or financial assistance. The development of a national water policy can introduce a variety of disincentives for excessive use through measures designed to shift more of the cost burden to the actual water user. These measures, however, would affect only that portion of Texas' water supply in which federal participation is required. For water projects outside federal jurisdiction, the responsible state agency can select its own measures to encourage conservation. A potential option open at both the state and federal level is to provide assistance, especially to agricultural water users, in financing water-conserving technologies.

Finally, the resource-use conflicts outlined in Section 3.1.1, above, which can potentially delay or curtail some surface water projects, require compromises between state and federal, or state and private interests.

RESOURCE MANAGEMENT ISSUE NO. 2

Consumptive Water Use

Finding: Power plant cooling accounts for most of the consumptive water use associated with the lignite development scenario. Among currently used cooling modes, those which hold down consumptive use result in higher thermal discharges, while technologies discharging little thermal effluent consume more water.

Issue: How can a balance be struck between the objectives of controlling unnecessary consumptive use and reducing thermal discharges, without excessive costs?

TABLE 3-2 CONSUMPTIVE WATER USE

Objective	Alternative	Implementation	Implications
Balance water conservation needs with siting flexibility and economic considerations	Tailor selection of cooling mode to site-specific factors of water supply and climate	• Revise EPA regulations regarding permitting of once-through systems • Apply EPA thermal discharge limitations to cooling impoundments at the point of discharge from the pond, not of the plant's discharge into it • Condition permitting on a showing that the most water-efficient cooling mode economically feasible for the site has been chosen	• Allows cost factors to motivate conservative use of water supplies • Wetlands impacts, siting difficulties may hold down use of once-through • Allows more thermal discharges, but a large proportion will be in off-stream cooling impoundments • Imposes no direct major siting limitations on any geographic region
Balance reduction of thermal discharges with economic considerations	Encourage use of wet cooling towers	• Designate wet towers as Best Available Demonstrated Technology for control of thermal pollution • Apply thermal discharge limits to cooling impoundments at point of plant discharge into the pond • Continue present requirements for studies/demonstrations in support of once-through cooling	• Higher total water consumption, statewide • Lower plant efficiency, increased cost • Thermal discharges to ponds reduced; discharges to natural watercourses may increase in number • Plants in humid eastern areas more severly penalized than those in drier southern areas
Minimize both consumptive use and thermal discharges	Encourage the use of dry cooling towers	• Designate dry towers as BADT • Apply discharge limits to point of plant release to impoundment • Continue present requirements for once-through cooling	• Large savings in water consumption, thermal discharges • Large plant efficiency penalties (> 10%) • High cost (four to five times that of once-through) • Towers may be very large, with aesthetic impact on landscape

3.2 Consumptive Water Use

A complex issue relating to water availability and quality revolves around the choice of power plant cooling technologies. In all steam electric power plants, regardless of fuel, the steam is recondensed after passing through the turbine, and recycled. About two-thirds of the fuel energy used to raise the steam in the boiler is still present in the spent steam as it leaves the turbine. This heat is removed by passing the steam through a series of tubes bathed in water. It is this condenser cooling water which carries off the waste heat not used in generating power.

A plant may be designed to use this condenser cooling water only once--the so-called once-through cooling system. Condenser cooling water may also be recycled. One method is to use a cooling tower where the condenser water is cooled by evaporation so that it can be used again. To prevent excessive salt buildup, a blowdown stream is withdrawn from the tower and replaced with fresh make-up water. The blowdown water is usually warm, but not as hot as water discharged directly from the condenser. A third method involves constructing an impoundment for cooling purposes. The plant takes cooling water from the impoundment and returns it directly without an intermediate cooling step. Cooling impoundments may also have to be blown down to control salts, but the discharge is not usually warm enough to be considered a thermal effluent. In all three methods, substantial amounts of water are consumed through evaporation.

Of the three, once-through cooling on a large multipurpose reservoir or at a coastal location consumes the least water. Thermal impacts in the receiving waters are highest, however, with this option. Also, it is difficult to obtain suitable sites in such locations, because of the value of the property for other uses. For many utilities, no such sites may be available within a reasonable distance of demand centers served. Finally, EPA requires extensive and time-consuming ecological studies to demonstrate that once-through cooling will not result in damage to pre-existing aquatic ecosystems.

Cooling towers consume more water, because they remove heat from recirculating cooling water by evaporation. They also increase the cost of power both by adding to plant operating and maintenance costs and by lowering its efficiency. The thermal impacts of plant discharge are considerably lowered, however. Cooling towers are best adapted to use in dry climates. In more humid areas, they consume more water and create greater plant inefficiencies. In Texas, cooling towers are not now considered economical in the humid eastern and coastal locations, in which most lignite is likely to be used. In drier south Texas, however, cooling towers may be used effectively.

Cooling impoundments also remove heat by evaporation, which takes place at the surface of the impoundment. They are an economic alternative to towers for recirculating systems in the more humid parts of Texas. A cooling impoundment in east Texas and a tower in south Texas, serving identical plants, would consume roughly the same amount of water. Thermal impacts of plant discharge in the impoundment itself may be very high, depending on its design, but impacts on natural watercourses are small or even, in completely self-contained systems, zero.

The Texas Department of Water Resources favors the use of once-through cooling, and considers control of unnecessary consumptive water use a key water management objective. EPA, under legislative mandate to control thermal effluents, discourages once-through cooling. Furthermore, EPA's regulations make a distinction between cooling ponds, which do not impede the flow of navigable waters, and cooling lakes, which do. Cooling lakes require the complex 316a procedure to permit once-through cooling, and discharge limitations apply to the point of discharge from the plant.

The Texas Department of Water Resources appears willing to apply discharge limitations at the point of discharge from the impoundment. TDWR will soon be authorized to administer the NPDES program by which power plant discharges are permitted. However, even then, EPA could not approve the issuance of a permit which allowed thermal discharges into an impoundment defined as a cooling lake.

From the utilities' perspective, flexibility in the choice of cooling mode is important from the standpoint of cost control. Thus, dry cooling towers, which both save water and eliminate thermal effluents would not be acceptable to utilities because of their very high costs and efficiency penalties.

Thus, the cooling-method issue can be seen as a three-way conflict, involving a balance between controlling consumption (TDWR), controlling thermal discharge (EPA), and controlling costs (utilities). The principal leverage in this situation lies with EPA. In 1976, EPA's New Source Performance Standards for water dischargers from steam electric stations were overturned on the grounds that adequate concern for water conservation was not represented in them. New standards have not yet been issued.

In developing such standards, possible means of striking a balance among the three conflicting goals involve the recognition of the following points:

- Climatic conditions dictate different cooling methods in different areas, based both on cost and conservation objectives.

- In naturally warm climates, such as Texas, aquatic ecosystems have been shown capable of tolerating temperatures at levels comparable to those in waters receiving effluents from once-through cooling.

- Although new impoundments, stocked with selected fish species, do not constitute natural, stable, aquatic ecosystems, many have for years sustained fish populations even at high ambient temperatures.

RESOURCE MANAGEMENT ISSUE NO. 3

Lignite Reserve Depletion

Finding: According to the lignite development scenario used in this study, most or all of the state's lignite reserves currently considered economically strippable are likely to be committed to combustion uses by the end of the century.

Issue: Should the state attempt to control this rate of commitment in the interest of lower long-term energy costs?

TABLE 3-3 LIGNITE RESERVE DEPLETION

Objective	Alternatives	Implementation	Implications
Control lignite consumption by increasing its price	Use of severence tax to reduce consumption	• State legislation • Tax could be applied to impact mitigation and/or RD&D into improving the economics of resource recovery and use (See Resource Management Issue No. 4)	• Tax may need to be high in order to significantly affect use • Burden of tax falls on energy users (i.e., Texas residents and utilities) • Increased utility bills for Texas residents (non-exportable) • Utilities already using lignite experience higher costs without being able to change fuels • Easy to administer
Control lignite development by reducing demand	Encourage the import of Mexican oil and gas	• International agreement between U.S. and Mexico • Series of independent transactions between PEMEX and U.S. oil and gas companies	• May be limited in effectiveness by MBFC policies • Involves international transactions • Environmentally desirable to continue to use cleaner fuels • Supply disruptions possible • Lessens ecological, social, and environmental impacts in lignite belt
	Encourage conservation	• National Energy Act • State Energy Conservation Program	• Effects limited to dampening overall demand (i.e., limited effect on lignite development) • Requires extensive public education and action to achieve significant results • Energy may be made available cheaply through conservation, as compared to new production • Lessens ecological, social, and environmental impacts on lignite belt
	Encourage increased use of Western coal	• Avoid universal full scrubbing requirement in NSPS revision • Restrain increases in Western coal rail tariffs • Restrain severance taxes in coal-producing states • Expedite federal coal leasing program	• Effectiveness is subject to price increases beyond control of state • Increase rail transport needs • Fewer siting constraints (requires proximity to rail rather than to lignite) • Improved air quality & greater siting flexibility • Increases demand for slurry pipeline • Lessens ecological, social, and environmental impacts in lignite belt • Increased competition between Texas and other states for Western coal
	Encourage nuclear development	• Encourage streamlined licensing, standardization, early site-certification policies at federal level	• Greater uncertainty about development; long lead times • Safety concern, waste disposal problems increase • Public opposition • Significant air quality benefits • Water consumption increases

3.3 Lignite Reserve Depletion

Projections of lignite demand used in the development scenario indicate that all or most of what is now considered the economically recoverable near-surface lignite reserve will probably be committed for use by the year 2000. This does not mean that all the strippable reserves will actually be consumed by then, but rather that they will be owned or leased by utilities or industries and committed for eventual use in an existing or planned facility.

This finding inevitably leads to the basic question of whether it is in fact in the best long-term interest of Texas to use its near-surface lignite deposits at such a rate, or whether the rate and scale of development should be managed to protect the reserve from premature depletion. In a few decades, it may be increasingly desirable to use synthetic gas and liquids, not only as fuel but as chemical feedstocks. The demand for synthetic feedstocks could be quite high in Texas, if the petrochemicals industry continues to grow.

If, by this time, lignite is not available, or the remaining reserves are very expensive, coal would probably have to fill the gap. If coal were to make up a greater part of the fuel mix in the next few decades, however, the lignite reserve might be "stretched" well into the next century. Lignite may well be worth more--both as a commodity and in its beneficial effect on the state's economy--as a feedstock for synthetics production.

The speed of depletion relative to the available reserve is sensitive to economic factors that make it feasible to recover deeper seams and thinner seams. If economically recoverable reserves are estimated on the basis of stripping to 200 feet, rather than 150 feet, the total is increased by more than 30 percent. Thus, improvements in mining technology or increases in price could strongly affect the rate of reserve depletion. Similarly, improvements in lignite utilization technology which lower operating costs permit higher-cost lignite supplies to be used without a net economic loss.

Even considering the effects of these economic forces, however, the ultimate limiting factor is the physical limit of the lignite deposits. The amount of Texas lignite available by strip-mining is small, compared with other coal resources. Thus, economic factors can modify the time frame of the reserve-depletion issue, but cannot eliminate it.

Left to itself, the market system will tend to allocate a given supply of lignite to short-term boiler uses.* Therefore, any attempt to curtail this trend will involve manipulating price and/or variables affecting lignite relative to competing fuels. If such manipulation can result in lower long-term energy costs, it may be viewed as a legitimate policy alternative. However, excessive interference with the market mechanism, or arbitrary allocation of lignite, would not only be difficult and costly to administer, but would meet with extremely strong opposition in Texas.

Several alternatives may be identified by which lignite use could be controlled. All face some impediment due to economic or regulatory uncertainty, and each could have a wide range of effects on lignite consumption, depending on how it is applied.

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*It is also possible, however, that potential industrial users of lignite as a feedstock can or do perceive the situation as described here. These interests are not prevented from acquiring and holding lignite reserves now, as "insurance" against future needs.

3.3.1 Severance Tax on Lignite

The effect of a severance tax would be either to raise revenue or to reduce consumption of lignite, or both, depending on the amount of the tax. To affect consumption, the level of the tax would have to be sufficient to make alternative fuels more economically attractive than lignite. Revenues from the tax could be applied to amelioration of impacts in the lignite development region, or to the encouragement of energy sources for use in the post-2000 period when lignite use begins to decline.

A major disadvantage of a severance tax is its impact on Texas consumers. Since lignite is expected to be consumed almost exclusively within Texas, the cost of the tax would be passed on primarily to Texas utility ratepayers and consumers. To the extent that lignite is used by industries which export their products out of state, the tax can be passed on to residents in other states.

Viewed principally as an intrastate tax, the question is whether the benefits of the tax outweigh the costs to Texas residents which would result.

Texas presently has severance taxes on oil and gas production, which go to the General Revenue Fund to finance state services and facilities. These taxes are 7.5 percent of the wellhead value of gas and 4.6 percent on oil production. The rationale for these taxes is to raise revenue for the state rather than to influence consumption levels. The point at which a severance tax on lignite would begin to affect consumption is influenced by several factors, including the delivered price of alternative fuels.

The option of imposing a tax on lignite rests with the state legislature. Such action can be taken independently of the federal government.

3.3.2 Encouragement of Mexican Oil and Gas Imports

The Mexican government has recently announced estimates of large amounts of oil and gas reserves, possibly the equivalent of 200 billion barrels of oil or more. The possibility of bringing these oil and gas resources to the United States through California and Texas is being actively pursued by several major concerns.

Introduction of a large, reliable, new supply of Mexican oil and gas into Texas fuel markets at a reasonable price would tend to weaken the trend toward coal and lignite. The principal energy rationale for conversion to coal has been the long-term shortage of oil and gas. These new supplies may not dramatically affect the fuel choice of utilities, but could significantly alter the future demand for lignite by industrial concerns along the Gulf Coast. The imposition of federal restrictions on boiler fuel choice, however, can significantly lessen the impact of Mexican oil and gas by diverting it into uses where lignite is not a competitor.

The State of Texas, by itself, can help streamline the process of permitting and constructing pipelines within its borders. The key decisions regarding the price paid to Mexico and the pricing of Mexican fuels for U.S. consumers, however, rest with the federal government.

Reliance on imports from Mexico would extend the current imports-related balance-of-payments problem. Supply interruptions and foreign pricing policies would be continuing concerns. However, spreading our import base might also be seen as a way to lessen our vulnerability to the vagaries of any one supplier.

3.3.3 Encouragement of Energy Conservation

The cornerstone of the National Energy Plan as proposed by President Carter is conservation of energy. To the extent that conservation can decrease energy demand, the demand for developing lignite will be diminished.*

In principle, energy conservation could result in considerable savings in lignite used. According to sensitivity tests applied to the development scenario in Chapters I and II, widespread use of existing technologies might be able to cut the amount of lignite committed in the year 2000 by 60 percent, compared with the moderate, Nominal Case. Savings this large which would require very large front-end investments may be difficult to finance.

Incentive measures, such as tax credits for investment, would not be likely to produce savings near the level theoretically possible. Price disincentives directed at reducing energy use would be needed to effect large savings. The state could institute incentives without prejudicing continued economic growth. A state-level system of price disincentives, however, would place Texas industry at a disadvantage relative to other states and reduce its ability to attract new growth. Price disincentives might be less inequitable if applied at the federal level. Federal initiatives could also be taken to provide financial incentives for conservation.

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*Volume I, Chapter I contains a discussion of the extent of conservation possible in Texas, and the factors constraining widespread conservation efforts.

3.3.4 Encouragement of Increased Western Coal Use

At present, there are no state or federal policies specifically aimed at increasing the use of western coal vis-a-vis other coal. The reverse is true in the case of proposed New Source Performance Standards under the Clean Air Act, which are intended to encourage use of eastern and midwestern coal.

Efforts to increase the use of western coal in Texas would likely reduce lignite use, because the two fuel sources are in close competition at present. The ratio of coal use to lignite use is projected to be about 40:60 through 1985, based on announced plans. This indicates that neither fuel has a compelling advantage, at least on a statewide basis.

Recently proposed NSPS requiring full scrubbing regardless of sulfur content (i.e., requiring scrubbers on all new western coal units where none was required previously) will tend to enhance the attractiveness of lignite even more. This strong trend would have to be overcome by any strategy to increase the use of coal relative to lignite.

The most effective measures to encourage coal use relative to lignite involve federal action. Leverage from the standpoint of scrubber requirements would have to be applied through EPA action. Currently, EPA policy is tending toward increasing control levels rather than relaxing them to a point where low-sulfur coal could be burned without scrubbers. A change in the Interstate Commerce Commission's attitude toward granting increases in rail tariffs for coal unit trains could at least prevent further erosion of coal's attractiveness in Texas. Expedition of the federal coal leasing program by the Department of Energy could have a short- to mid-term effect on supplies of western coal available. The resulting impact on use in Texas, however, would tend to respond more to scrubber requirements and freight rates.

Severance taxes imposed by producing states can be a significant component of delivered cost in Texas. The state of Texas is one of the litigants in a current court case, claiming that Montana's severance imposes an unconstitutional restraint on interstate commerce. The state thus has a direct avenue of action in this area, although the final decision will be made in a federal court.

3.3.5 Removal of Impediments to Non-Fossil Energy Sources

Encouraging non-fossil fuel energy sources, including nuclear power, will help meet the energy demand that lignite might otherwise fulfill. One problem with this alternative is that few actions are within the direct authority of the state. The policy initiatives encouraging expanded development of nuclear and other power sources must be taken primarily by the federal government.

Of the non-fossil energy sources, nuclear power has the greatest potential for short-term displacement of lignite. To date, Texas has not experienced strong public opposition to nuclear power plants. Four plants are under construction in Texas and others are planned. Opposition has increased in response to large cost overruns and construction delays. Cost overruns also plague large new coal-fired stations, however.

Nuclear waste disposal problems may be the major concern which will require resolution if a significant increase in the use of nuclear power is to occur. The possibility of nuclear power offsetting demand for lignite in fact appears to be diminishing at present.

RESOURCE MANAGEMENT ISSUE NO. 4

Lignite RD&D Priorities

Finding: Based on the lignite development scenario, it is likely that all or most of the currently economically recoverable Texas lignite reserve may be committed by the end of the century. Economics indicate that most of these commitments will be for conventional combustion uses.

Issue: How should Texas lignite research funding be spread among existing technologies and developing technologies?

TABLE 3-4 LIGNITE RD&D PRIORITIES

Objective	Alternatives	Implementation
Encourage expanded recovery of lignite resources	. Assess technical, economic and environmental impacts of surface mining for thinner and deeper seams . Assess technical, economic and environmental impacts of in-situ gasification techniques . Assess utilization of in-situ gasification product gases	. Continue appropriations for the Texas Energy Development Act of 1977
Encourage expanded development of lignite resource through removal of barriers to continued production and use of the resource	. Research emphasis on removal of barriers to production and use of the resource, including such areas as: Improved mining technology Improved economics of use Reclamation techniques Transportation Mining and power plant siting patterns Mining impacts on aquifers Surface water quality and quantity Sludge and ash disposal Air quality, especially additive impacts Various socioeconomic barriers	. Continue appropriation for the Texas Energy Development Act of 1977, with allowance for policy research
Encourage development of technologies which promise environmental and economic improvements in industrial use of lignite	. Assess technical, economic and environmental impacts of industrial lignite utilization techniques . Atmospheric research	. Continue appropriation for the Texas Energy Development Act of 1977, with allowance for policy research

3.4 Lignite Research, Development and Demonstration Priorities

Given current estimates of the near-surface lignite reserve and estimates of lignite demand by electric utilities and industry based on the Fuel Use Act, it appears likely that most or all of the recoverable near-surface resource may be committed by the year 2000. It also appears likely that the bulk of this resource will be used by electric utilities in conventional combustion processes. The demand for lignite by industry also appears to be of significance. The technologies through which lignite use will occur, however, are subject to technical, economic and environmental uncertainties. (Also see Resource Management Issue No. 3.)

Assuming that these findings are correct, it is logical that the state's energy Research, Development and Demonstration (RD&D) priorities should focus on three general objectives:*

- To encourage development of mining technologies which would allow recovery of the lignite resource which lies at depths below the currently strippable range,
- To continue to identify and mitigate barriers to economically, environmentally and socially acceptable recovery and use of the resource,
- To encourage the development of technologies which will make the industrial use of lignite more economically and environmentally attractive.

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*These objectives assume that the overall RD&D policy of the state is that expressed in the Texas Energy Development Act of 1977. This calls for funding of R&D into technologies which "offer the realistic promise of significant energy contributions within 25 years and which are of particular importance to Texas."

The reasoning behind the first objective is that if the bulk of the near-surface lignite will be committed for conventional direct-firing applications by the year 2000, it would be prudent to begin now to expedite investigation of in-situ extraction of deep basin lignite resources and more efficient recovery of surface mineable resources. Such technologies must be available before near-surface resource production begins to decline in the early twenty-first century.

An obvious approach to speeding up the commercialization of in-situ extraction is to conduct RD&D on underground gasification techniques. In addition to developing the gasification process itself, there is a need for RD&D into ways of cleaning up the product gas and economically utilizing it. Low heating value and logistics problems provide unique problems for utilization. The deep basin lignite represents a substantial resource but before it can be used to meet future energy demands it must be economically feasible to extract and to use.

Significant environmental barriers to in-situ gasification must also be overcome. Of particular concern is possible contamination of aquifers by the product gas, volatile materials, ash and partially combusted lignite. Legal questions also arise, relating to ownership of the lignite resource in the case of severed surface and mineral rights.

An important way of extending the economically recoverable strippable lignite reserve is to improve the economics of surface mining methods. RD&D focused on increasing the range of economic stripping ratios could significantly increase the strippable reserve. (Also see Resource Management Issue No. 3.)

The second objective assumes that one way to maximize energy development is by removing environmental, socioeconomic and policy-oriented barriers. For example, research on means of achieving more efficient and environmentally acceptable means of disposing of ash and scrubber sludges will reduce the barriers to efficient utilization of existing technology.

The third objective recognizes the apparent conflict between fuel use policy, environmental policy and economic growth with regard to the state's industrial base, particularly along the Gulf Coast. The Nominal Case Scenario developed in Chapter I estimates industrial use of lignite and coal based on assumed requirements of the Fuel Use Act. As pointed out in the siting analysis and in Chapters I and II, however, substantial uncertainty exists as to whether the objectives of the FUA can be accomplished concurrently with the need for environmental protection and improvement along the Gulf Coast and within the economics of coal/lignite versus oil/gas use in industrial operations. Although the constrained use of lignite by industry would extend the supply of lignite for electric power, industrial growth and stability may be impaired if sufficient fuels are not available. The development of technologies such as atmospheric fluidized bed combustion which offer promise of improving economic and environmental attractiveness of lignite use is therefore important.

Because of post-2000 supply limitations, the development of utilization technologies for which commercial availability is not expected in the next two decades does not currently appear cost-effective. Examples of such technologies include liquefaction and chemical processes based on lignite feedstocks. The charge of the Texas Energy Development Act of 1977 to encourage research in technologies which have the potential for "significant energy contributions within 25 years" is of special significance in this regard.

RD&D is carried out by a variety of groups in the state, paid for by federal and private monies, as well as by state funds. The Texas Energy Advisory Council, however, can strongly influence research priorities, as well as providing significant sources of research funds, through its administration of the Texas Energy Development Fund. If the objectives outlined above are to be pursued, this fund should continue to receive appropriations from the state legislature. Further focus could also be provided to the direction of lignite research by the establishment of a mechanism for coordinating all state-funded RD&D related to lignite or, more broadly, to energy in general.

RESOURCE MANAGEMENT ISSUE NO. 5

Utility Interconnection

Finding: Certain utilities within the Texas Interconnected System (TIS) are planning new lignite-fired power plants with interties into the interstate grid. Federal policy supports such interconnection.

Issue: Will interconnection increase the rate of reserve depletion and create an undue burden on Texas utilities and ratepayers?

TABLE 3-5 UTILITY INTERCONNECTION

Objectives	Alternatives	Implications
Provide for increased economies of scale and reliability for all Texas electric utilities without undue economic impacts on TIS members and customers	• Mandated interconnection of TIS with interstate grid for emergency transfers only, with guarantees of no additional federal regulation	• Would likely require new legislation to exempt TIS from regulations • Would not result in significant added lignite demand • Would enhance reliability of neighboring systems at the expense of TIS • Would not improve efficiency of all TIS members
	• Mandated interconnection of TIS with interstate grid, coupled with rates for intersystem sales which fully compensate exporting utility	• Possible long-term transfer of lignite-generated power to non-TIS consumers • Imposition of federal regulation on TIS members • Equity concerns could be addressed through a rate structure which could possibly lower customer rates in the exporting utility service area
Minimize federal involvement in intrastate power grid and preserve Texas lignite resource for Texas users	• Resist interconnection	• Protracted legal battles • Possible increased rates to non-TIS members within Texas • Minimal export of lignite-generated power
Spread the benefits of low-cost lignite-generated power to non-TIS consumers	• Mandated interconnection of TIS, with rates reflecting only production costs	• Possible long-term and continuous export of lignite-generated energy from TIS to non-TIS members (including other Texas consumers), at the expense of TIS members • Texas would bear additional environmental costs, including increased competition for PSD increments, etc.)

3.5 Export of Lignite-Generated Energy Through Electric Grid System

A major issue facing the Texas electric utility industry and state and federal regulatory agencies is the future status of the Texas Interconnected System (TIS). The TIS is the nation's only intrastate electricity grid. TIS is comprised of several large investor-owned utilities and several dozen publicly owned utilities which together account for approximately 85 percent of the state's electricity sales. At issue is whether this grid system should be linked with the large interstate grids surrounding Texas.

There are three clear-cut viewpoints on this issue, corresponding to three parties of interest.

The majority of the TIS members oppose interconnection, alleging that this would reduce reliability of the TIS system, impose additional federal regulations, and increase costs to TIS consumers. The concern which relates to lignite development is that eventually, relatively low-cost lignite-generated electricity might be exported to consuming states in much the same way natural gas is exported out-of-state at below market prices.

Some TIS members,* which are also corporately linked with interstate non-TIS members, favor interconnection to improve system reliability and reduce operating costs. The National Energy Plan, as proposed by the Carter Administration, also favored interconnection.

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*Central and South West Corporation (C&SW) member utilities.

The President's proposed National Energy Plan viewed power to require interconnections as a tool needed to ease a rapid transition from oil and gas to coal. Viewed in the national perspective, severe imbalances between utilities in the availability and cost of power could be avoided in this way. Depending on their current and planned fuel mixes, the impact of rapid conversion on utilities could differ considerably. Thus, interconnection might increase the impacts for some, while moderating them for others. The desired result would be a more even distribution of the cost of fuel conversion to all U.S. electricity consumers.

A key uncertainty in this issue is the extent to which lignite can be regarded as cheap compared with coal. Factors which can influence this comparison in the future include changes in the relative prices of the two fuels, and increasing difficulty in finding sites for lignite plants near the lignite deposits. Policy formulation affecting long-range transportation of sulfates could have a strong impact on the number of plants that could be built in the lignite belt itself.

4.0 RESPONSE ISSUES

Issues Related to Possible Need for New Policies

No. 1 Financing Community-Level Infrastructure

No. 2 Control of Water-Quality Effects of Flow Reduction

No. 3 Reducing Adverse Impacts of Reclamation on Wildlife

No. 4 Control of Boom-Town Growth

No. 5 Equitable Geographic Distribution of Lignite's Costs and Benefits

No. 6 Control of Aesthetic Deterioration

Issues Related to Implementing Existing Policy

No. 7 Approval of State Surface-Mining Program

No. 8 Identifying Lands Unsuitable for Mining

No. 9 Coordinating Multi-Agency Permit Review

The issues gathered under the heading of "Response Issues" all focus on the effects of lignite development, rather than factors controlling the rate and scale of such development. The Response Issues listed here are concerned with problems of site selection, as well as mitigation of post-operational impacts. Two main groups of issues have been identified, which distinguish between real policy gaps and areas where basic policy directions exist, but need to be worked out in detail.

4.1 Response Issues Related to Possible Need for New Policies

No. 1. Infrastructure Financing

How can adequate front-end monies be placed in the hands of local governments, faced with increased demands for services, in a timely manner?

No. 2. Flow Reduction and Water Quality

How can water use and water quality be jointly regulated so as to compensate for reductions in waste assimilative capacity resulting from increased consumptive use?

No. 3. Wildlife Impacts of Reclamation

How can incentives be developed that will encourage landowners to include wildlife values in post-mining land use?

No. 4. Control of Boom-Town Growth

What can be done to control the intensity of boom-and-bust cycles related to energy development?

No. 5. Regionwide Costs and Benefits

How might the economic and social costs of lignite development be spread equitably among all the beneficiaries of that growth?

No. 6. Aesthetics and Attitudes Toward Growth

Should attempts be made to control, or compensate for aesthetic impacts?

The first six Response Issues refer to problems which appear at present to have no institutional solutions, or where such solutions may be deemed inadequate. Initiatives lie largely with state agencies and the state legislature. All of these problems are specific to Texas, and occur on a more or less local scale.

RESPONSE ISSUE NO. 1

Infrastructure Financing

Finding: Lignite mining and mine-mouth power plant construction have caused and will continue to cause temporary and site-specific shortages of local government services and facilities. The problems of providing adequate services and facilities involve issues of timing and equity.

Issues:

(1) How can needed services and facilities be provided in a timely manner?

(2) How can adequate revenues be provided to the responsible local agencies?

TABLE 4.1.1 INFRASTRUCTURE FINANCING

Objectives	Alternatives	Implementation
Anticipate future development in order to extend planning horizon and provide adequate lead time	· Increase planning capability of local communities and regional COG's · Reduce uncertainty factors in siting and development process	· Utilize NEA planning assistance for communities affected by coal development · Utilize other existing mechanisms (i.e., Sections 701 and 208 of the Water Pollution Control Act Amendments of 1972; RCRA) · Require socioeconomic impact statement as part of state permitting process (RRC and PUC) · Establish county ordinance-making powers
Provide timely and adequate financial resources to local governments to meet sudden and significant new demands	· State/federal assistance in front-end financing	· Grants for development of new services/facilities · Loans (from government to commercial) · Bond or loan guarantees · Give communities affected by lignite development funding priority in existing programs, such as sewage treatment grants
	· Industry assistance in front-end financing	· Constitutional amendment allowing publicly owned utilities to be taxed as privately owned utilities are · Mandatory prepayment of taxes · Ad valorem tax on lignite in the ground · Voluntary assistance · Provision of some or all services and facilities · Goodwill payments to affected community
	· Direct compensation to individuals	· Taxes-in-progress should be included in utility rate base
Insure equitable allocation among local governments of revenues from mining and development.	· Greater reliance on user fees	· Alter tax structure to deemphasize property and sales tax and emphasize such revenue-raising devices as public school tuition, transportation tolls, park entry fees, etc.
	· Voluntary local government compacts resulting in "revenue sharing"	· Statutory enabling and coordinating legislation
	· State collection of local taxes for disbursement based on impact formula	· State-level assessment and collection of property taxes with disbursement back to affected communities
	· Shift more responsibility to the state for funding local services and facilities	· Special provision in Minimum Foundation Program for affected area · More state highways and parks · State Housing Authority

4.1.1 Infrastructure Financing

Local governments in small and medium-sized communities face several problems when experiencing rapid development, whether from lignite or from some other stimulus.

- School districts, counties, and municipalities have a constitutional debt ceiling which limits their ability to raise necessary revenue;
- New residential developments in a growing area create a net deficit in the school system. On an average, each new house will impose more expenses on a school district than it will generate in revenue through property taxes, especially if there is a great influx of mobile homes. As this cycle continues, a greater burden is placed upon non-residential land within the school district, especially open space or farmland. This is one factor that leads to the early conversion of farmland to urban uses and compels local governments to seek commercial and industrial developments which will generate more tax revenue per acre than other forms of land use;
- There can be considerable bureaucratic lag-time in receiving financial assistance for infrastructural improvements. For example, at least three years or more may be

required to receive grants for waste water treatment plants under Section 201 of the Clean Water Act. Also, fewer funds are available to small communities for sewage treatment improvement than to large communities.

- Federal impact assistance programs are often implemented very slowly. Also, authorized levels for assistance often exceed the actual amount appropriated by Congress. Im some instances, funds are authorized in substantial amounts, but never appropriated at all.

- In the case of education, capital expenses such as new classrooms are the responsibility of local school districts. There are no funds available at either the state or federal level for school district assistance with these capital expenses. Local districts do receive assistance from the State Minimum Foundation program, which pays approximately 50 percent of operating and maintenance costs. The level of assistance is directly tied to the average daily classroom enrollment.

- Jurisdictional problems often make it difficult for one political entity to qualify for assistance if the project is located in another's jurisdiction.

- Project impacts are rarely confined to the jurisdiction in which the facility is sited.

The state has no energy impact assistance programs for areas which might be affected by lignite development. Planning assistance is available pursuant to the National Energy Act in the amount of $20 million nationally. A region will be eligible after it has been designated by the governor of the state as being affected by rapid energy development. Generic impact assistance legislation has been proposed to Congress. The legislation, S1493, sponsored by Senator Gary Hart of Colorado, would provide more extensive impact assistance to energy development areas. The legislation was developed in cooperation with a National Governor's Association task force which worked in conjunction with an administration task force on impact assistance. The basic framework of the Hart bill was incorporated into the impact assistance portion of the National Energy Act.

The Coastal Energy Impact Program (CEIP), implemented in accordance with Section 308 of the Coastal Zone Management Act Amendments of 1976, provides planning assistance, loans and loan guarantees, bond guarantees, and grants for amelioration of loss of environmental and recreational resources in communities which are affected by coastal energy development. The program is administratively complex and has been slow in its initiation in many states. The CEIP has developed a methodology for calculating the impacts on a given community which might have application for an inland energy impact program.

RESPONSE ISSUE NO. 2

Flow Reduction and Water Quality

Finding: Consumptive water use related to the development scenario can reduce in-stream flows, resulting in lowered capacity to assimilate waste. The problem is not always severe, however, and could frequently be relieved by coordinating the management of water use and water quality.

Issue: Will the current institutional system develop in the direction of such coordinated management?

TABLE 4.1.2 FLOW REDUCTION AND WATER QUALITY

Objectives	Alternatives	Implications
Control or prevent water quality degradation.	• Condition water appropriations on maintenance of 7-day, 2-year low flows: ✓ At present levels (nondegradation) ✓ At levels which will allow standards to be just met (allowable degradation) ✓ At intermediate levels (analogous to current PSD increments)	• Solves the equity problem of pollution control cost by preventing it • Requires extensive modeling • May involve considerable new legislative and regulatory activity to implement as a nondegradation or intermediate degradation policy
	• Basinwide Coordinated Planning. Define consumptive use/assimilative capacity relationships. Allocate both consumption and waste loading jointly, in a forward-looking manner. The provisions of Section 208 of the water pollution Control Act Amendments of 1972 may provide a mechanism, through the concept of Best Management Practices.	• Controls degradation a priori • Significantly greater government involvement in siting • Requires very sophisticated modeling • Eliminates equity problem of pollution control. Introduces potential equity problems in siting, allocating economic opportunity
	• Monitor both water quality and flow regime jointly, for early detection of problems. Adjust wasteload allocations and/or reservoir releases to compensate for reduced flow: ✓ So as to maintain current water quality ✓ So as to meet standards ✓ So as to meet intermediate quality levels	. Because both quality and quantity are highly variable daily and seasonally, degradation trends may be advanced before they can be unequivocally detected . Requires an increased level of monitoring
Equalize the cost of pollution control between dischargers and consumers of water.	• Basinwide water treatment, funded jointly by consumers and dischargers on a pro-rata basis: ✓ To maintain current quality ✓ To meet standards ✓ To meet intermediate quality levels	• Equalizes--or at any rate distributes--pollution control costs, and may result in lower total expenditure • Requires considerable organization and probably involves a long lead time . Determining an acceptable proration of costs would be extremely difficult . Sizing and locating facilities would be a complex problem

4.1.2 Flow Reduction and Water Quality

As is discussed in Chapter IV (Section 4.0), the consumptive use of water that accompanies the development scenario is expected to reduce flows measurably in at least some basins. The widespread introduction of solid fossil fuels will entail roughly the same requirement for water regardless of whether lignite or coal is used. Economics presently indicate that lignite use will take place largely at the mine mouth, however, coal facilities are potentially less limited as to site. Thus, lignite use may tend to concentrate power generation in the Northeastern and North Central Subregions. Adding to the significance of this concentration is the relatively small size of most of the basins crossing the lignite trend in these subregions. A given consumptive demand will have larger impact on flows in smaller river basins.

In Section 4.0 of Chapter IV, it is demonstrated that lowering flow reduces assimilative capacity. Thus, if wasteloads remain unchanged, lower flows could cause a demonstrable deterioration in water quality in stream segments already carrying heavy waste loads. According to the water quality regulations published by the Texas Department of Water Resources, the policy of the state is to prevent degradation of water quality unless it can be shown to be necessary to the public good.

Another issue concerns the potential impact of flow reduction on achieving the water quality goals implicit in stream standards or quality criteria. Stream standards are set with reference to the seven-day, two-year low flow and consist of a set of water quality criteria and requirements intended to protect known suitable uses for the water from the stream. In streams with water quality problems, wasteload allocations are made so as to assure that the standards are met under seven-day, two-year low flow conditions. If the actual seven-day, two-year flow is reduced, then new wasteload allocations must be made if water quality is to be protected.

The mechanism of reallocating wasteloads to adjust for changes in water quality is built into the present administrative system. However, in the past, flow reduction has not been a significant contributor to quality problems. Reallocating wasteloads to compensate for flow reduction would place the economic burden of water quality control on a different group than that responsible for the problem.

This dilemma can be avoided by recognizing that surface waters serve two economic functions: assimilation of wastes and provision of water for cooling and/or raw material. Both are allocated by state regulatory bodies, whose activities can be coordinated so as to prevent the use of one from curtailing the enjoyment of the other. The recent merger of all Texas' water agencies under a single aegis can greatly facilitate the development of a coordinated management program.

Joint management of waste discharge and in-stream flows could be effected through one of two possible strategies, or a combination of both. Reservoir releases timed so as to maintain a certain minimum low flow could compensate for the effects of consumptive use on assimilative capacity. Such a scheme might also be required to protect downstream water rights. However, many reservoirs are not designed to be capable of the necessary flexibility of operation. A second strategy would, therefore, be to attack the problem from the timing of wasteloads, where stream flow cannot be controlled.

Wastes can be held during periods of low flow, for release when larger volumes of water are available.

An important distinction exists between the concept of low-flow maintenance and the use of flow augmentation to control pollutant concentrations. The former essentially seeks to maintain the status quo against changing conditions in the watershed. Existing dischargers are neither penalized nor benefitted by such a strategy. The latter, however, seeks to alter existing hydrological conditions so as to dilute pollutants discharged into the stream. This type of strategy can be administered as a substitute for effluent clean-up. Thus, dischargers could be able to meet water quality standards at lower cost than otherwise. EPA does not advocate flow augmentation as a means of pollution control. Waste storage for release according to streamflow conditions appears to be a potentially more acceptable approach.

The impending identification of required freshwater inflows into bays and estuaries may help to resolve the problems potentially caused by flow depletion. The release of these flows at the proper season may tend to counteract the reduction of low flows by consumptive use. Also, in finding mechanisms to deliver the required amounts of water it may become necessary to develop institutional means of coordinated reservoir operation. Currently, required downstream withdrawals and floodwater releases are the dominant considerations in timing reservoir releases. The estuarine inflow requirement places instream flows on an equivalent basis. Coordinating reservoir operation with instream flow needs for estuarine freshwater delivery and considering instream flow needs with respect to assimilative capacity are logical extensions of a similar management technique.

Section 208 of the Water Pollution Control Act Amendments of 1972 may provide a mechanism to manage instream flows with respect to water quality, although this approach is not now being assessed in the Section 208 program. The concept of Best Management Practices presented in this piece of legislation has so far been construed in terms of wastewater dischargers. If it were interpreted to mean management of assimilative capacity as well, then water quality plans formulated under Sections 201, 208, and 303 of the Act could include provisions for maintaining instream flows.*

The problem of reduced assimilative capacity due to consumptive use is not an intractable one, and possible solutions can be readily identified. Thus, the key issue here is whether the appropriate institutional structures will be developed to bring the problem and the solutions together.

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*Section 201 refers to individual municipal dischargers, Section 208 to areawide wastewater planning, including non-point sources. Section 303 requires basin-wide water quality planning, including wasteload allocation.

RESPONSE ISSUE NO. 3

Wildlife Impacts of Reclamation

Finding: Habitat conditions over much of the lignite belt are poor for wildlife, and could be improved by reclamation. At the same time, there is a large and growing demand for outdoor recreational opportunities easily accessible to residents to the metropolitan belts on either side of the lignite trend. Currently, ecosystem quality is not highly valued by landowners in general, and experience to date suggests a preference on the part of many to reclaim with monocultures of cultivated forage grasses, with very little value to wildlife.

Issue: How can incentives be developed that will encourage landowners to include wildlife values in postmining land use?

TABLE 4.1.3 WILDLIFE IMPACTS OF RECLAMATION

Objectives	Alternatives	Implementation	Implications
Prevent net degradation of wildlife habitat after mining	• Strict interpretation of language in Section 715.13 of the Federal Surface Mining Act concerning restoration of land to its former, or higher, capability of use	• Strong regulatory stance by OSM or Railroad Commission considering a straight monoculture a reduction in the capability of land to support a variety of uses. • Strong advisory role of Department of Parks and Wildlife, and U.S. Fish and Wildlife Service in approval of postmining land use and stipulation of mitigative measures to include management of surrounding habitat during mining.	• Potential conflicts between landowners wanting productive monocultures and regulatory agencies preventing them from free exercise of judgement regarding use of their own land. Operators likely to favor monocultures as cheaper, easier reclamation alternatives. • Conflicts with landowner over privilege to manage lands in own interests. • Lack of incentive to maintain habitat value after reclamation.
	• Provide tax incentives to reclaim lands for wildlife values	• Allow a temporary or permanent reduction or rebate of property tax on acreage reclaimed and managed for wildlife values.	• May not be sufficient economic incentive to replace overgrazing, poor management practices, or to compensate for perceived economic gain from reclaiming for grazing.
	• Encourage public participation in permit review	• Implement a strong campaign to raise public consciousness, provide assistance (such as transportation to hearings or rebate of expenses) to promote public involvement.	• Possible polarization of public opinion and loss of objectivity in planning, implementing reclamation. • Large expense of a thorough program; TDPW may not be able to finance, and federal agencies might be resented locally. • Public opinion has no real leverage on permitting.
Provide additional wildlife-related recreational opportunities	• Promote the development of a system of privately managed recreation lands, accessible to the public by lease or fee, centering around reclaimed lignite lands	• Arrange for TDPW to lease land reclaimed for wildlife from owners following reclamation. • Landowners provide access to public by short-term use fees; long-term use secured by sublease from TDPW. Use monies are remitted to landowner to defray costs of maintenance.	• Spreads cost of developing recreation lands among several entities; TDPW is currently limited financially. • Provides economic incentive to landowners to restore and maintain habitat. • If leases by TDPW extend beyond mine proper, an incentive is provided to improve management of unmined lands.

4.1.3 Ecological Impacts of Mining

One of the basic conflicts regarding the restoration of wildlife habitat as a post-mining land use is that other land uses are generally perceived to be more profitable. The Surface Mining Control and Reclamation Act, and the recently proposed Rules for the Permanent Regulatory Program, require that reclamation return land to a state capable of supporting all former possible uses (as measured against good pre-mining land management practices in the area), or "higher and better" uses. This approach is intended to prevent despoilation while still allowing the landowner the freedom to choose new uses for mined land which will increase its value. Although the "highest and best use" concept is an open-ended one, wildlife habitat *per se* is seldom considered "highest and best."

Aside from encouraging operators to use reclamation to enhance habitat wherever possible, and to avoid or fully restore certain riparian and wetland habitats, neither the law nor the rules appear to focus on concepts of ecosystem integrity. The bulk of the requirements for mitigating or avoiding adverse impacts on fish and wildlife refer to species and individuals (Section 816.92 of the proposed Rules). Habitat loss and attrition in general, however, not hazards from mining, appear to be one of the most significant problems facing fish and wildlife in the Lignite Belt. The reader is referred to Chapter IV, Section 6.0 for a discussion of wildlife management problems in the Lignite Belt.

A key feature of the Texas situation is that virtually all of the surface mineable lignite is under private land. Thus, post-mining land uses are chosen by individuals for whom economics, rather than conservation ethics, will typically be the key factor in the decision. The current trend in Texas is for many surface owners to choose for their land to be restored to cultivated pastureland. The resulting monocultures are often more profitable than the original assemblage of plant species, but are of much less value as wildlife habitat. If wildlife values are to compete successfully with cultivated pasture, a key issue involves determining whether productive monocultures are a "higher and better" use of the land than a mixture of native species. Both the Texas Department of Parks and Wildlife (TDPW) and the U.S. Fish and Wildlife Service are in a position to influence this determination, through their review and approval of mitigation measures associated with the chosen post-mining land use.

Public involvement is required in the permitting process. Decisions to grant or deny permits must take into account the results of public hearings. There is no requirement, however, for the decision to be made on the basis of public input. Thus, hearings provide little direct leverage. More significant than this, there has historically been very little public concern expressed over the effects of mining on habitat. Thus, there is no reason to expect that there will be much public pressure brought to bear in favor of identifying wildlife habitat values as a widespread reclamation goal.

The situation appears to be one in which economic incentives to private landowners are likely to have the strongest influence on reclaiming for wildlife. Tax incentives are an obvious possibility, but might prove difficult to set so as to achieve the desired result. A second alternative might be to attempt to make reclamation a means to fill a growing need for wildlife-based recreation. Hunting privileges have long been leased in Texas. However, other forms of outdoor recreation such as hiking, camping, and photography, in which wildlife is a definite factor, are also amenable to a leasing or user-fee system.

This alternative would provide a mechanism by which reclaimed mined lands would be made available, for a fee, to the public. The elements of this alternative include:

- Providing an economic incentive to the landowner to specify reclamation for wildlife
- Providing landowners with incentives to manage both reclaimed and surrounding land for wildlife
- Relieving the owner of part of the economic risk in selecting wildlife, rather than grazing, as a reclamation goal.

An arrangement for TDPW to lease lands reclaimed specifically for wildlife-related recreation would obligate the owner to avoid practices--such as overgrazing or allowing indiscriminate hunting--which degrade the restored habitat for its intended use. It would also provide a base income from the land, even if the demand for public use is low. Public use would provide additional income. The landowner, if free to set his own fees, would have an incentive to improve and maintain his property.

In the past, TDPW has had difficulty financing the purchase of large tracts of land for public recreation. A system of leasing might prove a means of making more land available to the public than would otherwise be the case. Additional funding might still be required, however, to assist TDPW in leasing large amounts of land.

A state severance tax on lignite would be one option for obtaining needed funds. Another might be the release of monies collected as mandatory reclamation fees, required by

SMCRA from all operators. Intended to pay for reclaiming abandoned coal mined lands nationwide, these fees place a disproportionate burden on states which, like Texas, have few unreclaimed coal mined lands to reclaim. Using these fees in Texas, to solve a Texas problem related to reclamation, would help to resolve this inequity.

RESPONSE ISSUE NO. 4

Control of Boom-Town Growth

Finding: Without proper planning, some communities near mine-mouth lignite power plants may undergo a sudden spurt of economic and population growth, followed by sharp decline as the construction of the facility is completed.

Issue: What can be done to reduce the intensity of such boom-and-bust cycles?

TABLE 4.1.4 CONTROL OF BOOM-TOWN GROWTH

Objective	Alternatives	Implementation	Implications
Reduce the extent of the "boom" part of the cycle	• Disperse growth among several communities	• Power plant siting authority • Land use controls • Voluntary consideration by utility or industry in siting	• Because of the relatively high density of communities along lignite belt, this dispersement will probably occur naturally
	• Encourage construction workers to commute from urban areas	• Vanpools, carpools or busing program sponsored by utility or construction contractor	• An organized means of mass transportation will increase safety, reduce tardiness, decrease individual costs • Parts of lignite belt are close enough to major urban areas to attract commuters • Not an appropriate government activity
	• Maximize recruitment from local area	• Coordination between utility, construction contractor, and government employment agencies	• Rarely is skilled labor available in small towns
		• Establish local training programs	• Currently company conducts programs (most appropriate) • State could establish vocational training
Stretch out the "boom"	• Phase construction of power plants to extend the construction phase	• Coordination between utilities to avoid simultaneous demands in a single area • Informal coordination by PUC • Power plant siting authority	• Phased construction of units and plants is most important of all alternatives
Limit the number of instances of the boom and bust cycle	• Power parks or clustered development	• Power plant siting authority • Variance from PSD	• Single areas affected severely • Requires long-range planning and careful coordination • Utilities and industries can benefit from economics of scale • Requires more transportation of lignite
Soften the "bust" part of the cycle	• Promote diversified economic growth in non-extractive industrial development	• Promote industrial development districts • Encourage cogeneration	

4.1.4 Control of Boom-Town Growth

The term "boom and bust" suggests visions of apocalypse. Therefore, it often arouses more public concern and attention than many other more threatening problems associated with coal and lignite development.

Although the "boom and bust" phenomenon has been a serious social problem for small, isolated communities in the West, the comparatively dense pattern of towns along the Lignite Belt, coupled with the proximity of large urban areas will naturally reduce the tendency toward serious "boom and bust" problems in Texas.* Also, PSD effectively creates a spacing pattern which will tend to disperse the location of coal- and lignite-fired units.

Several alternatives are available for addressing this issue. One approach is to reduce the "boom" in the boom and bust cycle. Another is to lengthen the construction period, resulting in a longer, but less intense "boom" and a smaller "bust." A third strategy would favor concentrating development in a smaller number of locations instead of creating scattered minor socioeconomic and environmental impacts over a large region. Finally, the "bust" part of the cycle can be reduced by creating a diversified industrial base which would last beyond the construction phase and, in time, the mining phase. This alternative would be hampered if PSD increments were consumed over large areas by one or two power plants, thereby reducing the potential for other heavy energy-using industry.

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*See Chapter IV, Section 7.0.

RESPONSE ISSUE NO. 5

Regionwide Costs and Benefits

Finding: The most probable pattern of lignite development, at least in the short term, involves siting power plants at the mine mouth, which transmit power to the large urbanized areas on either side of the Lignite Belt.

Issue: How might the economic and social costs of lignite development be spread equitably among all the beneficiaries of that development?

TABLE 4.1.5 REGIONWIDE COSTS AND BENEFITS

Objectives	Alternatives	Implementation	Implications
Share the costs of energy production with beneficiaries outside the Lignite Belt	**• The costs of impact mitigation to be carried by utility ratepayers**	• Severance tax on lignite, with revenues for impact mitigation in the Lignite Belt • Government surcharge on utility bills with distribution to affected local governments in Lignite Belt • Utility surcharge with rebate to affected local governments in Lignite Belt • Payment by utilities (voluntary or government-mandated) to jurisdictions affected by lignite development	• Internalizes cost of development--reduces "hidden costs" • Mitigation costs in direct proportion to energy use--very equitable • Higher utility bills, transferring resources to areas affected by lignite development • Difficult to calculate "net impacts" so that ratepayers are not overcharged--imprecise • Does not resolve question of how to transfer funds from utility to local governments for services and facilities • Consumer opposition likely
	• The costs of impact mitigation to be carried by state and federal governments	• State/federal legislation to establish impact assistance program • Adoption of lignite severance tax--revenues earmarked for mitigation of impacts	• Spreads cost of mitigation to taxpayers statewide and/or nationwide • Recognizes general public benefit of lignite development • Assistance can go directly to local governments • Increased administrative costs--"red tape"
Provide additional opportunities for secondary growth in producing regions	**• Diversify development**	• Establish regional development commission • Develop coordinated state government program (such as TIC involvement) to encourage siting in region	• Insures long-term stable and balanced economic growth with attendant benefits • Requires directing economic development to the Lignite Belt--concerted and coordinated effort • Efforts may be limited by certain factors such as transportation, labor supply, infrastructure • Other regions of state may object to priority attention for Lignite Belt

4.1.5 Regionwide Costs and Benefits

Mining of lignite and construction of mine-mouth power plants will clearly result in appreciable economic benefits to the Lignite Belt region of Texas. Because of these benefits and because of the advantages of using this readily available alternative energy source, maximum development of the lignite resource is generally viewed as desirable and economically beneficial on balance.

Lignite development will, however, impose certain economic costs on the Lignite Belt region along with the benefits, and may also result in future regional economic development which is heavily dependent on a single resource. The costs of this pattern, which translate into higher taxes or user fees, include: increased demands on public services and facilities, such as schools, police and fire protection, hospitals, etc.; and the need to finance new infrastructural development such as roads, streets, sewage treatment systems, waterworks, and utilities. Certain essentially non-economic costs also result. These include traffic congestion and noise, pressures on social and political institutions, loss of wildlife habitat, aesthetic change, air quality degradation, and social and environmental impacts. The economic benefits resulting from lignite development are obvious, but because neither mining nor power generation is labor-intensive, growth immediately related to it may be very narrowly based.

Since the lignite resource runs through essentially non-metropolitan areas of the state, the energy developed in the region will be exported to other areas, namely the large metropolitan areas on both sides of the Lignite Belt. In terms of value added to the economy, these energy-consuming areas may derive substantially more of the benefits from lignite development than the producing region. Of concern is whether, despite the obvious direct economic benefits of development to the region, the Lignite Belt may, on balance, receive comparatively few of the long-term benefits, experience a disproportionate number of costs, and find itself overly dependent on the economic fortunes of lignite.

There are two basic strategies for developing a more equitable distribution of costs and benefits between the Lignite Belt and beneficiaries of lignite development outside the producing region. One strategy involves spreading the costs more widely, and providing assistance to local areas in mitigating growth impacts. The other seeks to compensate the lignite region by increasing its share of the jobs and other economic benefits resulting from the use of the energy produced there.

4.1.5.1 Alternatives for Cost-Spreading

Calculation of "net costs" to local governments in the region is difficult. Some maintain that incremental long-term revenues exceed long-term costs resulting from energy activity. This leads to the conclusion that the principal problem for local governments in attempting to provide adequate new services and facilities is one of timing of aid, not amount of aid. Others contend that a new long-term deficit in local government budgets results, and that the only recourse is to raise taxes to make up the difference. This debate was at the center of Congressional consideration of the Coastal Energy Impact Program under Section 308 of the Coastal Zone Management Act of 1976. One implication of the "no net revenue loss" argument is to give more emphasis to planning assistance, loans, and loan/bond guarantees, which tend toward reimbursable front-end financing. The "net budget deficit" concept emphasizes grants and other non-reimbursable methods of assistance.

Impact mitigation measures are usually hampered by inability to be precise. Ideally, assistance should go to those bearing the costs, in the exact amount of those costs, and at the time the assistance is needed. It is not only difficult to calculate net costs precisely, but it is also difficult to devise revenue transfer mechanisms which can be both precise and administratively efficient.

Revenue-raising devices such as a severance tax on lignite production, a state surcharge for power produced by utilities using lignite, or a sales tax with dedicated revenues, will likely encounter significant utility ratepayer opposition. The 1978 special legislative session removed the four percent sales tax from utility bills in order to reduce already high utility bills. Such devices would also tend to affect small consumers, more than large users.

A severance tax could be applied specifically to lignite development, whereas sales taxes or surcharges on utility bills would tax all energy generation, regardless of fuel source.

4.1.5.2 Alternatives for Benefit-Sharing

Some argue that direct compensation to persons who incur the costs of energy development is preferable to assistance to local governments. This approach would require cash compensation to individuals, who could in turn decide which and what level of local government services they would like. Automatic provision of new services and facilities would not be presumed. Compensation devices include rebates or lower utility rates in affected communities, and direct government payments.

Cogeneration refers to the simultaneous generation of electricity and process heat. Traditional coal generation power plants use only about 30 percent of the heat potential of the energy source. By utilizing the waste heat in the form of process steam for industrial purposes, the plant efficiency can be raised to about 75 percent. Cogeneration provides an attractive way to maximize use of the lignite resource and simultaneously attract energy-consuming industries to the region.

Revising the State Implementation Plan for air quality to require the most stringent controls possible would have the economic effect of allowing more industrial growth in a given area. Improvements in air quality through controls on existing and new air pollution sources would preserve part of the allowable increment under the Federal Prevention of Significant Deterioration (PSD) policy for use in accommodating new growth.

Reclassification of the Lignite Belt from Class II to Class III under PSD would allow a greater degree of air quality deterioration (i.e., industrial expansion).

None of the alternatives mentioned are exclusive of the others. All the courses of action mentioned could be implemented at the same time, although it is not likely that both government and utilities would be used simultaneously as mechanisms for transferring financial resources to the Lignite Belt. A coordinated program combining impact assistance features and incentives for non-lignite-based economic development could significantly reduce any possible regional disparities in the distribution of costs and benefits as use of the lignite resource accelerates.

A key unknown in all of this is the degree to which lignite development will act as a catalyst for rural industrialization. There is widespread belief that lignite development will lead to a wide variety of secondary economic growth in the Lignite Belt. Thus, this issue is not generally perceived as significant. However, as discussed in Chapter III, there are several reasons to suspect that such growth in the Lignite Belt may be limited, or dispersed over a much larger area than the immediate vicinity of the lignite mining districts.

RESPONSE ISSUE NO. 6

Aesthetics and Attitudes Toward Growth

Finding: Lignite development will alter the appearance of the landscape both directly, through mining and use, and indirectly through residential and commercial development. Although many feel this activity will cause visual blight and erode the overall quality of life in the Lignite Belt, most Texans appear to be relatively more receptive to growth and its consequences than the nation as a whole.

Issue: Should these aesthetic concerns be addressed, and if so, how?

TABLE 4.1.6 AESTHETICS AND ATTITUDES TOWARD GROWTH

Objective	Alternatives	Implementation	Implications
Minimize visual blight associated with haphazard secondary development.	• Land use controls	• Existing municipal zoning • Granting counties ordinance making powers • Subdivision ordinances	• Land use controls are very controversial in Texas; county zoning would require state-level enabling legislation
	• Reduce billboard proliferation	• Existing Highway Beautification Act and sign ordinances	
	• Encourage good development	• Requires land use planning and local consensus	• Strictly voluntary
Preserve selected areas from development in order to retain and enhance character of the landscape.	• Government purchase of scenic areas for use as parks	• More state parks • More national forests • More county parks	• Planning and acquisition should begin early to avoid high costs. • Texas Parks & Wildlife Dept. should step up land acquisition program
	• Strict land use controls which prohibit all but agricultural uses	• County zoning powers • National or state land use controls	• Involves "confiscation" or "taking" issue; politically unacceptable; least expensive preservation technique; requires legislation.
	• Government purchase of "scenic easements"	• Land title remains with farmer/rancher, state pays owner in exchange for a promise not to alter landscape; mainly along highways	• This has the effect of alternative discussed immediately above except the state or county pays and the landowner is compensated; would require enabling legislation.
	• Declare some areas "unsuitable for mining"	See Response Issue No. 9	• Resource is unused • Mineral owners deprived of revenues
Maximize the distribution of the economic benefits of lignite-related development in order to minimize antagonistic local attitudes toward growth.	• Insure that residents derive benefits from new power stations	• Discourage location of power plants outside of service areas through siting authority	• Unfair to utilities which do not serve the lignite belt. • Might tend to reduce lignite use
	• Insure that the developments are fairly assessed such that eventually residents may derive net tax benefits from project	• Provide for payment in lieu of taxes by publicly owned utilities	• Would require enabling legislation
		• Uniform tax assessments	

4.1.6. Aesthetics and Attitudes Toward Growth

There are some environmental and social impacts which are difficult to assess because they do not measurably affect human health, nor do they create direct or measurable economic costs. There is no consensus as to what constitutes "quality of life." Nevertheless, there is often opposition to major energy or manufacturing facilities based on perceptions that growth and change are inherently bad.

It appears that the opposition to energy development in Texas is relatively less than in much of the rest of the nation. Such objections as have developed have been centered largely on economic, rather than aesthetic, issues. One factor behind this may be that Texas has a tradition of oil and gas production, which in the past has stimulated boom-town developments in producing areas and major refining petrochemical complexes along the coast. The development of the Lignite Belt, which in many areas coincides with the oil boom areas of the past, may be viewed by some residents as merely a reenactment with a different fuel and different methods of extraction and use. The frontier ethic, with its impetus toward conquest of the land and sense of individual rights to independent action, is still strong in Texas. Nevertheless, the alterations of the landscape by direct and indirect impacts of lignite devleopment can occur in such a way that opposition to continued development will mount.

Three basic approaches to mitigating aesthetic concerns and anti-growth sentiments have been identified here. The first seeks ways to control the growth and nature of development through land use controls (zoning and subdivision ordinances), highway beautification, and voluntary land use planning, in which local governments' capital improvements are designed to reduce the likelihood of haphazard growth. The second objective addresses the aesthetic and growth concerns by carving out and setting aside areas which will be preserved from future developments. Since Texas has much less land set aside for public parks than most other parts of the country,* this alternative may represent a particularly effective method of reducing or precluding anti-growth feelings through preservation. Finally, the third alternative recognizes the fact that many of the negative attitudes toward growth are borne by those who perceive that they have everything to lose and nothing to gain from future development.

One method for implementing the third strategy is to ensure that the residents of the area affected by lignite development will benefit by reduced or stabilized utility rates, and by reduced taxes. If the electricity is "exported" to another service area or if the affected communities do not receive tax benefits, residents may feel exploited and alienated. On the other hand, it is not reasonable to prohibit utilities from developing lignite outside their service areas nor is it reasonable to prohibit publicly owned utilities from development because they are exempt from taxes. (The problem related to service areas is compounded by the competition among utilities over sometimes very limited air resources - i.e., PSD increments.) Some form of payments-in-lieu-of-taxes could either be permitted or required to address the growing problem of energy development by tax-exempt entities.

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*According to the 1975 Texas Outdoor Recreation Plan, published by the Texas Parks and Wildlife Department, state parkland in Texas amounts to 6.3 acres per 1,000 persons, compared to 30.7 per 1,000 nationwide.

These three strategies each overlap measures of dealing with other Response Issues. Planning orderly growth and avoiding haphazard sprawl not only reduces the adverse aesthetic effects of rapid community growth, it allows more efficient and, in some cases, less costly development of new services, such as streets, sewers and water supply. Thus, aesthetic concerns can be worked directly into the resolution of issues over infrastructure planning and financing. The concept of protecting unique natural, cultural, or historical areas is the basis of the Federal Surface Mining Control and Reclamation Act's provision for declaring lands unsuitable for mining. Finally, Response Issue No. 5, dealing with equitable sharing of the costs and benefits of lignite development, addresses means of increasing the Lignite Belt's share of the positive impacts of development.

4.2 Response Issues Related to Implementing Existing Policy

No. 8. Approval of State Surface-Mining Program

What options are available to Texas with regard to obtaining state jurisdiction over surface mining under the federal law?

No. 9. Lands Unsuitable for Mining

Should the state act prospectively now to designate areas unsuitable for mining?

No. 10. Multi-Agency Permit Review

Should the state establish a formal mechanism to coordinate siting decisions?

The last three Response Issues address problems of carrying out existing policy directions. Decisions required center mainly around the definition of regulatory procedures and clarification of jurisdictions. Number 8 involves federal, as well as state action. Numbers 9 and 10 are exclusively Texas problems.

RESPONSE ISSUE NO. 7

Approval of State Surface-Mining Program

Finding: Disapproval of the state's surface-mining regulatory program by the Office of Surface Mining (Department of Interior) could result in direct federal regulation of the mining of Texas lignite.

Issue: What policy options are available to Texas with regard to submittal and approval of the state program in order to maintain exclusive jurisdiction over lignite mining and reclamation?

TABLE 4-2.1 APPROVAL OF STATE SURFACE MINING PROGRAM

Objectives	Alternatives	Implementation	Implications
Maintain continued exclusive state jurisdiction over surface mining by gaining approval of the state program	Submit state program without change	• Submit existing law, regulations, procedures, etc., without change according to OSM program approval procedures • No new or amended legislation required	• Reduced or possibly no chance of federal approval • Additional costs and/or restrictions on mining and reclamation due to federal controls • Reduced/preempted state authority over mining • Places burden on federal agency to specify shortcomings of state program
	Amend state law and regulations according to state interpretation of what would be "consistent with" federal requirements	• Amend state law and regulations in next session of legislature • Submit program for approval or seek six-month extension to have adequate time to amend law	• Places burden on state to interpret what changes are necessary to conform with federal law • Lack of federal guidance may make amendments difficult to adopt • Reduced chance of federal approval • Maximizes state discretion to decide on essential changes • Demonstrates good faith effort to conform
	Amend state law and regulations only after receiving definitive indication from OSM regarding necessary changes	• Amend state law and regulations • Seek six-month extension on submission to gain time to amend state law	• Clear federal guidance may never come • Lack of time before next legislative session • Improved chance of federal approval, with resulting costs/benefits
	Rewrite state law entirely to track federal law verbatim	• Introduce complete new bill which tracks language of federal law for every provision required for program approval	• State resistance to adopting entirely new law when present one was tailored to comply with federal law may be substantial • Improved, if not guaranteed chance of federal approval

4.2.1 State Surface Mining Program Approval

The Federal Surface Mining Control and Reclamation Act was adopted in 1977 to provide a comprehensive national framework for the regulation of surface mining and reclamation activities with regard to coal, including lignite. Implementation of the federal legislation takes place in two steps. The first step was the promulgation of interim program regulation addressed federal enforcement procedures and specified seven performance standards which must be met by any surface mining operator. The second phase of the implementation is the promulgation of nationwide permanent program regulations for all surface and underground coal mining operations.

Proposed rules on the permanent program were published on September 18, 1973, 43 Federal Register No. 181, and are scheduled for final promulgation in March, 1979. States are required to submit a program in accordance with the federal regulations by February 3, 1979, although a six-month extension is available. The Office of Surface Mining in the Department of Interior has six months from that date of submittal to either approve or disapprove the state program.

Texas adopted a state surface mining regulatory law in 1975, entitled the Texas Surface Mining and Reclamation Act. The state law covers surface mining for both coal/lignite and uranium, whereas the federal law addresses only coal. Pursuant to the state law adopted in 1975, the Texas Railroad Commission adopted regulations requiring reclamation of surface-mined lands to their original or a substantially beneficial condition. In addition, provisions are made for designating areas as unsuitable for mining, restoring the mined area to its approximate original contour, and requiring the posting of performance bonds to ensure that reclamation is completed.

The Texas Surface Mining and Reclamation Act was drafted during the period of congressional consideration of federal surface mining controls, and was considered on the premise that federal legislation would pass either in the near future or at some later date. As a result, the Texas law is more similar to the federal law than any other existing state statute.

Texas has had an advantage over other states in that surface mining in the state is relatively new and is not as well established as the industries in states such as Kentucky and West Virginia. Therefore, the Texas Railroad Commission has had a better opportunity to lay a groundwork for regulation without having to contend with a long history of mining in the state.

In June, 1977, the Library of Congress, Congressional Research Service, issued a report on state surface mining laws in comparison with the proposed federal legislation. In that report Texas was compared favorably to other states with respect to the comprehensiveness and stringency of the state law. The following assessment is provided in the Library of Congress report:

> In comparison to other state laws on surface mining and reclamation, the law enacted by Texas would undoubtedly have to be considered to be one of the most comprehensive and most stringent. Many of the provisions relating to the reclamation standards established for the industry are either identical to or very similar to those contained in the federal legislation. Furthermore, in many of the sections where differences between the state law and the federal proposal do occur, the State Railroad Commission has included language encouraging modification of the state law in the event that more stringent federal legislation is subsequently enacted.

The Office of Surface Mining has provided policy guidance to states as to what changes will be required in individual state programs in order to gain approval to assume exclusive jurisdiction over surface mining within that state. This guidance is in the form of a memorandum from the national office, which specifies which provisions of the federal statute are applicable to state statutes and must appear in the same or a similar form in the state law.

Part 730 of the proposed permanent program regulations sets out general requirements for regulatory programs in the various states. The approach taken is that the law and regulations must be "consistent" with the federal requirements although provision is made for the state to apply for a variance from the federal performance standards and other requirements for permitting bonding, inspection and enforcement in order to take into account geological, topographic, climatic, hydrologic and other regional conditions which support alternative approaches. A state law or regulatory provision which is considered more stringent than the federal requirements is construed as consistent, or at least not inconsistent with the federal act and regulations. The term "consistent with" is defined in the federal regulations to mean "the same or similar to."

Texas state officials have expressed concern that despite the similarity of the Texas act with the federal law, and the comprehensiveness of the state regulatory approach, that the Office of Surface Mining may not approve the state program as submitted and that, therefore, federal jurisdiction over surface mining and reclamations will be exercised in Texas. In a statement to the Office of Surface Mining public hearing panel on October 27, 1978, Texas Railroad Commission Chairman Mack Wallace stated that "flexibility and sound judgment by the state, although recognized in the act because of what the act identifies as 'diversity in terrain, climate, biologic, chemical, and other physical conditions...' has been precluded." In particular, Commissioner Wallace criticized language in the proposed federal regulations which defined the term "consistent with" to mean "the same or similar to." He said that he felt that this interpretation was not what Congress intended nor was it desirable from a policy point of view.

The Texas law and programs differ from the Federal law in the following respects: (1) reclamation is required to restore a substantially beneficial condition, rather than a condition which would sustain the same or a better use than those possible before mining; (2) mixing of strata is allowed if the operator can demonstrate to the satisfaction of the Railroad Commission that a mixture of strata will be as suitable for revegetation as segregation and replacement of topsoil; (3) no citizen suit provision is provided; (4) the period of responsibility for revegetation is slightly different, and the implementing mechanisms are different than under the federal act.

Supported by recommendations of the Texas Mining Council and the Railroad Commission, a bill proposing to enact an entirely new state law, that would conform to federal requirements, has been introduced into the Sixty-Sixth Legislature.

RESPONSE ISSUE NO. 8

Lands Unsuitable for Mining

Finding: Roughly 375,000 acres would ultimately be disturbed by mining in the development scenario used as the basis of this report. There is a potential for loss of certain scenic and environmentally sensitive areas. Under the state's surface mining and reclamation act, the Railroad Commission may prospectively designate areas unsuitable for mining.

Issue: Should the state act now to delineate environmentally sensitive areas, or other areas unsuitable for mining; or should this judgment continue to be made on a case-by-case basis?

TABLE 4-2.2 LANDS UNSUITABLE FOR MINING

Objectives	Alternatives	Implementation	Implications
Minimize the permanent loss of critical or environmentally sensitive areas from surface mining, and provide greater regulatory certainty for potential developers	Conduct sensitive-areas survey of Lignite Belt, and designate prior to mining areas considered as unsuitable for surface mining.	• State appropriation for survey • Federal grant for survey, combined with state matching funds • Amend state law to require prospective designation • Federal overrride of state authority	• Ensures early protection of sensitive areas • Provides advance notice to operators about excluded areas • May tend to be overinclusive • Expensive and time consuming • Requires additional TRC funding
	Continue present policy of receiving petitions for designation and making determinations on case-by-case basis at time of permit application		• Designation at time of permit application subject to more influence from parties of interest • Administratively simpler for TRC • May be preempted by federal requirements in any case • Only requires survey of area actually sought for mining--less expensive

4.2.2 Land Unsuitable for Mining

Estimates of the number of acres in Texas which will be disturbed by surface mining operations vary considerably. The Office of Surface Mining in the U.S. Department of Interior, utilizing U.S. Bureau of Mines figures, estimates that 251,400 acres overlie strippable reserves in Texas. Other estimates of the area overlying lignite reserves in Texas range up to one million acres and more. The development scenario used in this report yields a total of 374,000 acres disturbed by mining the reserves committed through the year 2000. Regardless of the exact number of acres, there is a significant potential for mining to be conducted in environmentally sensitive areas, or areas presenting other problems, such as natural hazards, which would make them unsuitable for mining and preclude proper reclamation. A particular concern in Texas is mining in major floodplains which cross the Lignite Belt in several places (see Resource Management Issue No. 1).

Both the Federal Surface Mining Control and Reclamation Act and the Texas law provide for the designation for areas as unsuitable for mining. Pursuant to Sections 102, 201, 503, and 522 of the federal act, part 764 of the proposed permanent program regulations issued by the Office of Surface Mining sets out a minimum program for approved state programs by which areas can be designated as unsuitable for surface coal mining operations. Section 7 of the Texas Railroad Commission rules, issued pursuant to the Texas Surface Mining and Reclamation Act, set out a similar procedure for designation of areas as unsuitable for mining. Texas is one of only three major mining states in the country which presently includes a provision for designation of areas unsuitable for mining in its state law.

Texas' provision is the most similar to the federal provision of any of the state laws. Several differences between the two provisions exist, however.

- The Texas provision allows a petition to be filed by any person with the Railroad Commission. If the petition is declared complete and valid, it is placed on file with the Railroad Commission. Action on the petition does not occur until an application for a surface mining permit for the area or a portion of the area included in the petition is filed with the Commission. At that time, a hearing is conducted by the Railroad Commission and a survey of the area is made, and a determination is made by the Railroad Commission as to whether the area meets any of the criteria in the state provision. In the federal rules, action must be taken on a valid petition within ten months of its being filed by the state agency conducting a public hearing. A determination of whether the petitioned area should be declared unsuitable for mining must be made no later than twelve months after filing the petition.

- The state provision directs the Railroad Commission to make a determination on whether an area should be declared unsuitable for mining even in the absence of a petition being on file, whereas the federal provision appears to rely upon the filing of a valid petition in order to trigger agency action.

The Texas law does not direct, but allows the Railroad Commission to survey the Lignite Belt in advance of a petition being filed in order to determine prospectively whether there are areas which potentially will be mined that would qualify for a designation as an area unsuitable for mining. This authority is not expressed in the Texas act, but is implied. Exercise of this authority would likely depend upon the availability of funds to conduct an areawide survey of the Lignite Belt, as opposed to a discrete survey of a specific proposed mining site at the time a permit application is filed. In addition to the availability of funds, the desirability of providing prospective notice to potential lignite operators in the state may influence the decision whether to conduct a survey and designate areas as unsuitable for mining in advance of any specific plans to mine that area.

The criteria for designating areas as unsuitable for mining are essentially the same in both the federal and state laws. They include:

- Fragile or historic lands where mining operations could result in significant damage to important historic, cultural, ecologic, scientific, or aesthetic values or natural systems;

- Renewable-resource lands where mining could result in a substantial loss or reduction of long-range productivity for water supply or food and fiber products;

- Lands subject to natural hazard, such that mining could substantially endanger life and property.

The effect of designating an area as unsuitable for mining is to preclude mining altogether. Although this is an absolute constraint on surface mining, there is a direct relationship between the criteria for designating an area unsuitable for mining and the criteria for denying a permit application. A failure on the part of the operator to demonstrate that mining and reclamation is feasible will result in the permit application being rejected under other provisions of both the federal and state laws. It is also unlikely that an operator will be able to demonstrate compliance with the various performance standards in the state and federal laws if features which would make an area susceptible to a designation as unsuitable for mining are present.

RESPONSE ISSUE NO. 9

Multi-Agency Permit Review

Finding: Statutory responsibility relating to the siting of lignite mines and associated power plants rests with several permitting and reviewing agencies. Each has jurisdiction over only a part of the total project's impact. Currently, there is no formal governmental mechanism for coordinating these decisions.

Issue: Should the state establish a formal mechanism for coordinating siting decisions for power plants and other large projects?

TABLE 4-2.3 MULTI-AGENCY PERMIT REVIEW

Objective	Alternatives	Implementation	Implications
Minimize unnecessary delays, jurisdictional conflicts, uncertainties and costs of permitting	TNRC coordination of lignite-related policies, procedures, regulations and programs among state agencies	• TNRC initiative to review lignite activities	• Relies upon existing institutional mechanism • Emphasizes cooperative approach and improved communication to overcome conflicts • TNRC is untested in achieving coordination
	Establish consolidated permit authority for mines and power plants (i.e., state siting authority)	• State legislation to establish centralized siting authority	• Reduces fragmentation of authority • Provides focus for public input • Focuses regulation on comprehensive evaluation of proposed project • Minimizes conflicts over jurisdiction • Increases overall administrative costs • Historically low acceptability in Texas • Counter to current policies of reducing state bureaucracy
	Seek delegation of authority for federal regulatory programs to reduce state-federal duplication and conflict	• Possible amendment to state laws and regulations to meet Federal program qualifications • Application to appropriate Federal agency (EPA, Interior) for approval of state program	• Minimizes state-Federal conflicts • Requires state conformance with Federal guidelines and rules • Does not necessarily reduce state-level conflicts • Eliminates EIS requirement
	Reduce information requirements and impose tight time deadlines on permits	• State agency review of procedures and rules with revisions aimed at reducing paperwork and time	• Saves administrative and applicant time and costs • Speeds up administrative review of permit • Less comprehensive review of impacts • Possibly increases litigation potential

TABLE 4-2.3 (continued)

Objective	Alternatives	Implementation	Implications
Ensure that all significant impacts are addressed in permitting process and that public input is present	TNRC coordination of lignite-related policies, procedures, regulations and programs among state agencies	• TNRC initiative to review lignite activities	• Relies upon existing institutional mechanism • Emphasizes cooperative approach and improved communication to overcome conflicts • TNRC is untested in achieving coordination
	Establish standardized impact assessment methodology	• Adoption of a standard assessment procedure (such as the Activity Assessment Routine in the proposed Texas Coastal Management Program)	• Increases consistency in permit review • Improves predictability • Requires administrative adaptation • Facilitates public participation by using standard format
	Establish consolidated permit authority (siting authority)	• State legislation to establish centralized siting authority	• Reduced fragmentation of authority • Provides focus for public input • Focuses regulation on comprehensive evaluation of proposed project • Minimizes conflicts in jurisdiction • Increases overall administrative costs • Historically low acceptability in Texas • Counter to current policies of reducing state bureaucracy
	Establish consolidated permit process with lead agency approach	• Revise state legislation to require only one permit from lead agency for the activity, rather than individual permits for the separate impacts	• Requires no new state agency • Improves agency lead coordination • Focuses review process in one agency • Facilitates public participation

4.2.3. Multi-Agency Permit Review

The issue of conflicting and duplicating jurisdiction and decisions is constantly a problem to government regulatory agencies and project managers alike. The problem is not unique to lignite-related developments, but should be raised once again as development and utilization of Texas lignite resource accelerates.

A primary policy objective is to make expeditious and coherent decisions regarding the impacts of siting major lignite-related facilities, especially power plants. Efforts to reduce administrative delays, jurisdictional conflicts and unresolved policy issues will help to achieve an expeditious determination of where a power plant can be sited. Coordination of permit review procedures will insure that all significant impacts of a proposed project are considered and that the series of regulatory decisions concerning a project comprise a coherent package which is consistent with broad public policy goals.

Texas is presently seeking NPDES water quality permit authority from EPA, is revising its State Implementation Plan for air pollution, will likely seek approval of the state surface mining program from Department of Interior, and will at some point resume federal certification of its hazardous waste regulatory program. The result of these transfers of authority is expected to be a steady decline in the number of cases where a NEPA-format EIS is required for larger power projects. (This trend is discussed more fully in Section 5.1, below).

Several states have established a central power plant siting authority. Texas continues to use a decentralized regulatory approach which addresses the individual effects of siting rather than controlling the siting activity itself. The political appeal or acceptability of establishing a central power plant siting authority remains low in Texas.

Establishing a power plant siting authority is only one approach to achieving improved coordination of agency decisions. Another is to create a consolidated permit review process within an existing agency whereby only one permit is issued, but it is reviewed by the various agencies according to their traditional jurisdiction. An example of this at the federal level is the licensing of deep-water ports, pursuant to special authorizing legislation, by the Department of Transportation. Another approach is to designate a lead agency which is responsible for coordinating permit review on an interagency basis. A fourth alternative is to use a formal interagency coordinating mechanism such as the Texas Natural Resources Council.

Texas established the Natural Resources Council in 1977. It is comprised of the heads of twenty-five resource agencies and chaired by the Governor. Its primary goal is to coordinate coastal policies and administer the Texas Coastal Management Program, but is responsible for coordinating and streamlining all state natural resource policies and procedures.

Conflicts, duplication, and gaps in state-level conflicts can be presumed, but are difficult to document. Reorganization efforts are often premised on the existence of such problems, but find it difficult to devise an organizational structure that reduces the net number or magnitude of such conflicts.

Texas Railroad Commission authority to regulate surface mining is the closest to a comprehensive and consolidated regulatory approach to a given activity that exists in Texas. Despite the comprehensiveness of the state surface mining act, jurisdiction is shared with other agencies, particularly the Department of Water Resources.

The Advisory Committee to the Texas Coastal Management Program discussed, but did not recommend that the Texas Air Control Board's consideration of the land use implications of its permit decisions be expanded to include more than simply local zoning decisions. Such a policy change could effectively allow air permit review to become a forum for consideration of the broader socioeconomic and land use effects of power plants and other facilities. The Air Control Board has in the past contended that this would convert the agency into a siting authority with decisions based on non-air-quality criteria.

5.0 INTEGRATING PERSPECTIVES ON POLICY ISSUES

Decisions concerning the issues set forth in the preceding sections will be made by different groups of people, responsible to different constituencies, and often working toward different goals. In many instances the groups participating in these decisions may not be fully aware of each other's goals and viewpoints. Although confrontations will arise, they will almost always be over single issues.

This final section is an attempt to describe in broad outlines the relationships between key policy objectives, showing where they move in common directions and where they conflict. The resolution of an issue in terms of a particular objective may logically restrict choices in other areas while implying the adoption of other objectives with related effects. Failure to recognize such relationships may result in the conflicting policy directions which tend to cancel each other's effects.

In addition, several basic underlying issues will be pointed out. These issues concern major policy trends and their cumulative effects. These larger issues recognize key ideas that unify and connect the individual issues and their potential resolution.

5.1 Underlying Issues

A close analysis of the eighteen issues discussed in Sections 2 through 4 above reveals a number of common threads unifying them. Four of these basic underlying concerns warrant specific mention:

- Limitations in the requirement for environmental review of new projects

- Environmental costs not yet internalized

- Regulatory uncertainties that interfere with long-range financial planning

- Equity versus efficiency in resource allocation.

An exhaustive analysis of these complex topics is well beyond the scope of the present study. They are included here, however, because an analysis of policymaking with respect to lignite would be fragmentary without mention of them. The resolution of any one of these policy issues has implications for these concerns, and an awareness of them lends valuable perspective to the cumulative effect of individual decisions.

5.1.1 Limitations in Environmental Review

Between now and the year 2000, the State of Texas may reasonably be expected to take over the administration of most of the large federal permitting programs pertaining to new lignite-based facilities. These include air and water quality, surface mining, and solid waste disposal. Since there is very little federal land in Texas, this may result in a substantial number of new facilities being built without undergoing a complete and formal environmental review under NEPA. The only major federal actions not now or soon likely to be administered by the state are dredge and fill permits from the Army Corps of Engineers, and exemptions or conversion orders under MBFC policy administered by the Department of Energy. Dredge and fill permits will be required for only a portion of the total number of mines and conversion facilities required.

Texas lacks a requirement for comprehensive environmental review at the state level. Responsibility for various environmental impacts is spread among several agencies, varying considerably in their authority (see Response Issue No. 10). Additional guidelines and requirements may be introduced through the promulgation of rules and regulations for the implementation of federal programs. The net effect, however, could be more confusion than clarification.

NEPA and similar comprehensive review processes instituted by some states provide an avenue for public participation both through hearings and in the courts. NEPA contains no requirement to use the results of the required environmental review in the process of undertaking a major federal action. Nevertheless, suits brought by public interest groups on the basis of the adequacy of the review ultimately brought about not only far-reaching expansions of its scope, but were able indirectly to force cancellation of projects by inducing costly delays. The impact of these suits was undoubtedly responsible in part for the increase in environmental awareness among policymakers and industry. Now, this incentive may be at least partially withdrawn at a time when increasing economic pressures and rising energy demand are causing some to call for a re-examination of the nation's environmental values.

5.1.2 Internalizing Environmental Costs

The years since NEPA's passage have seen the development of a body of legislation specifically aimed at protecting the environment. These laws have formally internalized the environmental costs of economic activities through the imposition of requirements for control technology or standards of practice. This trend may be seen as tending to replace the earlier process of comprehensive but non-restricrive environmental review. The greater the internalization of environmental costs, the more incentive there is to make environmentally sound decisions in planning and design.

A broad variety of environmental costs have now been internalized, and developing policy in the area of solid waste, surface mining, and toxic substances will internalize still more. Three kinds of environmental costs stand out, however, as remaining largely external:

- Chronic health impacts of air and water pollution
- Damage and deterioration of ecosystems
- Aesthetic degradation.

Each of these costs is directly related to the rate and scale of lignite development in Texas. Relevant discussions may be found in Section 2.3, 4.1.3, and 4.1.6 above. Sections 2 through 7 of Chapter IV contain further details regarding the possible extent of these impacts in Texas.

Two characteristics make these costs hard to internalize. First, it is presently very difficult to quantify them, both because of incomplete scientific understanding and the inherent subjectivity with which they are experienced. Second, there is very little agreement on what constitutes an acceptable level of damage or risk.

The costs of chronic health effects arising from low-level concentrations of air and water pollutants are in principle possible to internalize by limiting emissions and controlling waste disposal. However, it will take years of epidemiological research to establish dose-response relationships. Even when such information becomes available, there remains the question of acceptable risk. Attempting to internalize these costs too soon, before a numerical criterion can be grounded in fact, could result in overestimating them.

Fish and wildlife values were once at the forefront of the environmental movement. This original impetus has been translated into regulations that are chiefly designed around individual species. The costs that have been most successfully internalized are those of the extinction of uncommon species. Efforts to preserve habitat quality have not yet internalized the costs of all habitat factors which may experience deterioration. Thus in aquatic environments, the deterioration of water quality has been dealt with, but not interference with flow regimes or the fragmentation of habitat by impoundments. In terrestrial ecosystems, the costs of surface mining are being reflected in the cost of energy, but the costs of associated human acitivity damaging to wildlife and habitat are not. In Texas, the impacts of surface mining and power production cannot be considered apart from an overall trend of habitat attrition which has greatly changed the character of ecosystems over the course of the century. Although the costs of continuing this long term degradation are difficult to tie to the costs of producing energy, such a trend can effectively nullify the most expensive efforts to reclaim mined lands and to control plant siting.

Finally, aesthetic degradation is easily the most problematic of all these costs. In principle, it can be incorporated into the broad social and economic costs of energy development and related economic growth by establishing standards ranging from simple aesthetic guidelines for structures to strict land use control. The difficulty is not in finding ways to internalize costs, but in attempting to achieve a public consensus on how much internalization is desirable. Unfortunately, aesthetic impacts are often essentially irreversible.

The basic questions regarding the internalization of these three kinds of environmental costs are: first, to what extent should they be internalized; and second, how rapidly should we attempt to do so. The value to society of preventing these impacts must be established. The costs of forestalling them will be large in that the impacts themselves are diffuse and involve many media. Thus, a serious attempt to control them simultaneously or over a short time frame might entail major economic consequences.

5.1.3 Long-Range Planning Under Conditions of Uncertainty

At the present time, government is in the process of formally internalizing not only the cost of some kinds of environmental damage, but also the cost of depleting limited reserves of natural gas as well as the cost of increased independence from foreign oil suppliers. All of these efforts add directly to the costs of any industrial firm, and affect its financial position. Since every firm experiences slightly different costs, competitive relationships stand to be altered as well. This element differentiates industry from utilities and materially increases the potential impact on the individual firm of changes in the cost of doing business.

Considerable uncertainty surrounds several areas of developing policy. Recently passed laws* mandate the regulation of previously unregulated substances and new standards of practice for a large number of processes, which have yet to be developed. The National Energy Act institutes a new and complex procedure for authorizing fuel use in major industrial boilers, which has yet to be tested in practice.

However, the most significant aspect of these new laws, as relates to uncertainty, may be the trend toward requiring continual update, expansion, and adjustment of the body of regulation they authorize. Thus, Section 106 of the Clean Air Act Amendments of 1977 gives EPA an open-ended mandate to review and revise standards every five years, adding new ones "as may be appropriate." Section 120 specifically requires the Agency to consider means to protect the public from any injurious effects of sulfates, radioactive emissions, cadmium, arsenic, and polycyclic organic matter. Thus, industries can look forward to a future in which large but unpredictable additions to their environmental control costs may occur. A similar open-ended mandate is given to the Department of Energy in requiring categories of existing industrial boilers to switch fuels.

The net result is to make it extremely difficult for industry to calculate the long-term risks involved in large capital investments. Fuel choice, equipment design, siting, and selection of environmental control measures are all affected by this uncertainty. Significantly, with regard to government RD&D efforts, new technologies may be rendered even more risky investments than their economics alone would suggest.

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*Most notably, the Clean Air Act Amendments of 1977, Resource Conservation and Recovery Act, and Water Pollution Control Act Amendments of 1977 call for extending or altering current regulations and standards of practice.

5.1.4 Equity versus Efficiency in Resource Allocation

Many of the policy issues discussed in the preceding sections involve the allocation of a limited resource: oil and natural gas, water, or the assimilative capacity of the environment. As the costs of environmental damage are internalized, the environment's capacity to absorb impacts becomes a resource as potentially limiting to industry and power production as fuel and raw materials. Every policy decision regarding resource allocation and cost involves two key factors: economic efficiency and equity.

The criteria of efficiency and equity tend to pull in opposite directions. Efficiency calls for the distribution of limited resources to users with whom the use of a unit of the resource produces more jobs, personal income, value added, etc. These users can pay higher prices for the resource and an unhampered market system will tend to distribute it to them. However, concerns for equity usually result in applying some form of priority system or restrictions so as to protect prior users, and to prevent unfair competition.

There appears to be a built-in difficulty inherent in the basic structure of many governmental units which makes an effective compromise between equity and efficiency hard to achieve. The legislative-executive-judicial structure which makes, implements and interprets laws is, considered in a very simple way, largely a mechanism for resolving disputes. Long-range planning to live with resource scarcity has only recently come to be seen as an important function of government. Rather, the general intent has been to preserve the freedom of individual opportunity to exploit resources. Equity concerns--the rights of individual entities--have historically been paramount considerations in lawmaking. Now, however, this tendency to treat decisionmaking as an adjudicatory process can be seen to hamper efforts to use the governmental system as a mechanism for planning.

This conflict is easily seen in the form of the mandatory boiler fuel conversion policy embodied in the National Energy Act. The Act itself begins by setting forth a straightforward set of guidelines for the allocation and use of natural gas and oil as boiler fuel. However, in an effort to provide flexibility that will protect equity concerns, the actual implementation of the MBFC has been cast in the form of a complex system of exemptions, administered on a case-by-case basis. This kind of system can tend to keep the future somewhat unpredictable with respect to long-range planning for new facilities. It is also capable of introducing new equity problems arising from its administration.

A broader question of equity versus efficiency arises from the general trend toward internalizing environmental costs. Small industrial firms may be less well equipped to deal with these costs, especially in the face of regulatory uncertainty, than large ones. Larger diversified firms with multiple installations have greater flexibility in the choice of strategies for continued growth under conditions of evolving policy. The costs involved in meeting a new regulation or standard are more easily spread and absorbed in a diversified industrial firm than in a smaller one, limited to only a few products and processes. Also, as the costs of environmental protection mount, there is a greater risk of inflation and competition from foreign products. Large firms may be better equipped to cope with these effects. Finally, firms that control substantial shares of the market for their product may experience less risk in making capital investments under conditions of uncertainty. Thus, a trend differentially favoring big industry may be inadvertently developing from the totality of our policies for allocating environmental and fuel resources.

REFERENCES CITED: CHAPTER V

1. Chemical Week, November 22, 1978, p. 11.

2. Chemical and Engineering News, November 27, 1978, p. 18.

3. Files, J.T., 1978, Houston Area Oxidants Study, Environmental Science Technology, 12:638-640.

4. Dimitriades, B., 1978, EPA's View of the Oxidant Problem in Houston, Environmental Science Technology, 12:640-643.

5. Federal Register, Vol. 43, No. 118, 1977 Clean Air Act: Prevention of Significant Air Quality Deterioration, State Implementation Plan Requirement, Monday, June 19, 1978.

6. Office of Technology Assessment, 1978, Application of Solar Technology to Today's Energy Needs, Vol. I, Washington, D.C., O.T.A., vii + 525 p.

7. Demand and Conservation Panel of the Committee on Nuclear and Alternative Energy Systems, "U.S. Energy Demand: Some Low Energy Futures," In: Abelson, P.H., and A.L. Hammond (eds.), 1978, Energy II: Use, Conservation and Supply, Washington, D.C., Amer. Assoc. Adv. Sci., v + 201 p.

8. Hirst, E., and J. Carney, "Effects of Federal Residential Energy Conservation Programs," In: Abelson, P.H., and A.L. Hammond (eds.), 1978, Energy II: Use, Conservation and Supply, Washington, D.C., Amer. Assoc. Adv. Sci., v + 201 p.

9. Texas Railroad Commission, Gas Utilities Docket 719.

10. Texas Railroad Commission, Gas Utilities Docket 1055.

11. Gautam, S.R., H.B.H. Cooper, Jr., and R.W. Miksad, 1978, "An Assessment of Air Quality Impacts of Coal and Lignite Use in Texas," paper presented at the 71st Annual Meeting of the Air Pollution Control Association, Houston, Texas, June 25-30, 1978.

12. McNeely, J.G., and R.D. Lacewell, 1977, Surface Water Development in Texas, Texas A&M University, Agricultural Experiment Station, 44 p.